MODEL 1125
TRANSMISSION TEST SET

MAINTENANCE

Northeast Electronics Instruction Manual
D1125-00-601 Issue 1 August 1988

tau-tron
A UNIT OF
GENERAL SIGNAL

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– WARRANTY –

ALL TAU-TRON TEST SETS ARE WARRANTED AGAINST ANY DEFECTS IN MATERIAL AND WORKMANSHIP, FOR A PERIOD OF *3 YEARS.*

This Warranty applies from the date of delivery for all Tau-tron test sets. Other manufacturer's products offered by Tau-tron such as printers, cables, etc. are covered to the extent of their own warranty. Calibration of Tau-tron test sets is covered for one year from date of delivery. However, some restrictions apply; see your salesman for further details.

We will repair or replace test sets which, upon our examination, prove to be defective during the warranty period, except in cases of product abuse or attempted field repair.

No other Warranty, expressed or implied, including fitness for purpose, merchantability or otherwise, is given.

For assistance, contact Customer Service with details of the instrument model, serial numbers, and malfunction; see Repair Returns on the next page.

SHIPPING DAMAGE

If any signs of damage are noticeable on the outside of the carton, request that the carrier's agent be present during unpacking. If external damage is found on the instrument, follow the Repair Returns procedure below.

Check the electrical performance of the instrument as soon as possible after receipt. If there are any malfunctions, follow the Repair Returns procedure below.

REPAIR RETURNS

In case of mechanical damage or electrical malfunctions, notify Tau-tron immediately. If the damage occurred during shipping, also notify the carrier. To return a unit for repair:

1. Call the Customer Service Department, **(508) 692-5100** or **1-800-344-8131**, for a **Repair Authorization Number**. This number reduces administrative delays and ensures prompt return of your unit.

2. Complete and attach the **Repair Tag**, in the back of this manual, **to your unit** for positive identification.

3. Pack the unit in the original shipping carton and packing materials, if available. Otherwise use a double-walled carton (test strength of 350lb; 159kg) and shock-absorbing material such as bubblewrap, to prevent the unit from moving in the carton during transit. Secure the carton by sealing it with heavy paper tape.

4. Send to: Tau-tron Inc.
   10 Lyberty Way
   Westford, MA 01886
   Attn: Customer Service

SERIAL NUMBERS:

This manual covers all serial numbers ranging from,

90-01-000 to 93-12-00.

UNIT CLEANING AND LUBRICATION:

There is no need for lubrication of units, or internal cleaning. These units have been sealed and should not be opened.

CALIBRATION OF UNITS:

Each unit is marked with a calibration sticker. Calibration should take place one year to the date shown.

It is the sole responsibility of the owner to decide if the calibration will be done by Tau-Tron.

PROMULGATION PAGE

This is to certify that this Commercial Manual contains *Proprietary Data* that is proprietary to Northeast Electronics Division of Tau-tron Inc. Northeast Electronics retains all rights and privileges for the aforementioned technical data.

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SECTION 1
GENERAL DESCRIPTION

1.1 INTRODUCTION

This manual covers the Northeast Electronics Model 1125 Transmission Test Set including calibration and maintenance information. This document includes all current schematics, component location drawings and parts lists. This instrument is owned, manufactured and supported by Northeast Electronics.

(a) Maintenance

This section provides instructions for maintaining this test set. No routine preventative maintenance is required other than the normal cleaning procedures.

(b) Parts List

This section contains a list of all the replaceable parts by assembly associated with this unit.

(c) Appendixes

This section contains any information on this Transmission Test Set that is not found in any other section of this manual.

(d) History

This section contains the past history of the changes that have been incorporated into this unit since the last overall manual revision. The purpose of this section is to allow this manual to function as a data base for several revisions of this unit.

(e) Comments Welcome:

Please communicate to Northeast Electronics any questions or comments regarding the scope, accuracy, or presentation of this material. Northeast Electronics will thoroughly evaluate all comments and reply when appropriate. Direct communications to:

Technical Publications Department
Northeast Electronics Division
57 Regional Drive
Concord, New Hampshire 03301

Phone: (800) 222-4124 or
(603) 228-3700
FAX: (603) 228-0340
Telex: 510-600-8628

1.1.1 INSTALLATION AND OPERATION

This section contains information and instructions necessary for installation, interfacing and proper operation of this instrument.

1.1.2 Initial Inspection

This unit has been carefully inspected both mechanically and electrically before shipment. It should be free of defects and should be operating correctly when received. To confirm this, the test set should be inspected for damage received while in transit. Note any damage to the shipping container. Carefully unpack the product and inspect for damage. If damage from transit is found, immediately inform the carrier and contact our Traffic Department at (603) 228-3700. Check the equipment received against the purchase order and shipping list. Report any missing items to our Customer Service Department.

1.1.3 Preparation For Use

The portable test set requires very little preparation for use. Place the test set on a convenient work surface. Secure the carrying handle, where applicable, in a position to tilt and lock the test set at a convenient viewing angle.

1.1.4 Service Information

If a product fails to perform as expected, call our Repair Service Center in Concord, New Hampshire at (603) 228-3700 for assistance. This step helps prevent the unnecessary return of a product.

Prior to returning a product for factory service, call our Customer Service Center to obtain a Return Material Authorization (RMA) Number. Return products directly to our Service Center in Concord, New Hampshire. If a product is still under warranty, include a ship-to address and a description of the problem. After the warranty period, include all of the following information:

- Purchase Order Number
- Bill-to address
- Ship-to address
- Description of problem

1.1.5 Power Requirements

The Model 1125 can be operated from either the internal battery pack or from an external AC power source. The AC power input is protected by a 1/2 amp,. slow-blow fuse located on the rear panel.

Note: The test set cannot be operated in the battery mode while connected to an external AC power source.

Units equipped with the DC power option operate on 115 VAC 60 Hz, with a battery back-up system. If the unit is connected to an AC outlet, the battery is charging. The Model 1125 may be used on battery power for up to 3.5 hours. A low battery indicator on the front panel indicates operational time is limited to 15 to 30 minutes and that the unit should be connected to AC power to fully charge the battery.

(a) If the unit must be left on while charging, it will receive a trickle charge.

(b) With the unit turned off, the battery will be fully charged in approximately 16 hours.

1.1.6 Interface Requirements

The test set is equipped with two types of input/output connectors. The T and R connectors are standard size binding posts. These binding posts are spaced to accept a standard dual banana plug. The other type of connector is for the WECO 310 plug.

1.1.7 Grounding Requirements

To protect operating personnel, the National Electronical Manufacturer's Association (NEMA) recommends that the instrument panel and cabinet be grounded. The test set is equipped with a three-conductor power cable which, when plugged into an appropriate receptacle, grounds the test set.

WARNING: To ensure operator protection, connect the rear panel ground terminal to earth ground when operating in the battery mode.

1.1.8 Environmental Requirements

(a) Operating Environment

In order for the test set to operate within specifications, the operating temperature must be within the range of 0 degrees to +50 degrees Centigrade (+32 degrees to +122 degrees Fahrenheit). The relative humidity must be within 10% to 90% noncondensing and the unit must be operated below 5,000 meters (16,404 feet) of altitude.

(b) Nonoperating Environment

The test set can be stored in an environment in which the temperature is between -40 degrees and +50 degrees Centigrade (-40 degrees to +122 degrees Fahrenheit), the relative humidity is between 10% and 90% noncondensing, and at an altitude of below 15,000 meters (49,213 feet). A 20-minute warm-up period following a 2-hour stabilization period at +15 degrees to 25 degrees Centigrade (59 degrees to 77 degrees Fahrenheit) should be advantageous before making any performance tests.

1.1.9 Rack Mounting

The Model 1125 can be rack mounted in either a 19-inch or 23-inch rack using the optional 19- or 23-inch rack mounting adapters that can be purchased separately.

1.1.10 Operation

Section 7 provides operating instructions that includes explanation of the use and function of each control and front panel feature. Power on, test setup, and measurement operations are also provided.

SECTION 2
MAINTENANCE

2.1 TROUBLESHOOTING

Troubleshooting the Model 1125 involves three distinct kinds of activities: (a) a self-test routine, (b) performance tests, and (c) overall failure checks. Before going to any of these activities, try to recall any pattern of failure, any erratic behavior of the Model 1125 that repeated itself. Such a pattern often gives a clue to the location or nature of the failure. If there is no observable pattern or clue, begin troubleshooting by restarting the Model 1125 to see if the automatic self-test routine will identify the problem. If it does not, go to the overall failure checks and after that the performance tests.

(a) Self-Test:

The Model 1125 is equipped with a self-test routine that checks major circuit functions. This testing is automatically carried out each time the set's power switch is turned on. Each test result in the series appears in the left display as either PASS or FAIL. The corresponding number of the test simultaneously appears in the right display. If a test results in a FAIL, the failure message can be looked up in Table 2.1-A or in the APPENDIX (Section 4.0), or Section 7. (The self-test can be bypassed or terminated by pressing any key on the keypad.)

(b) Performance Tests:

Do not confuse the self-test routine with the manual performance tests explained later on in this manual. The manual tests are not automatic; they must be initiated and conducted by a user. Performance testing is necessary following calibration and at any time an internal failure of the Model 1125 is suspected. Before performance testing, however, go to the overall malfunction checks.

(c) Overall Malfunction Checks:

Overall malfunction checks are normally conducted immediately following a failure of the Model 1125 during routine circuit testing, assuming the self-test routine reveals no internal problem. At this time, the test set operator or another user does preliminary, overall checking in order to isolate, if possible, the general location of the problem. These checks—of visual externals, power source, display, and circuit boards— are explained in the following paragraphs.

(d) External Related Failure:

If the self-test routine reveals no malfunction, then make a visual inspection of the Model 1125 and its surroundings. Look for physical damage, loose cables, or other potential external factors. External factors can include high temperature, excessive moisture or dust, and nearby equipment radiating magnetic fields.

(e) Power Related Failure:

The Model 1125 power supply is common to all three measuring circuit boards, as well as the display panel. Consequently, if both displays are affected by a failure (blanking, blurring, or incorrect characters), the problem is likely to be power related. If both displays are blank when they should give readings, check the following:

1. the power cable is tightly inserted in an external power source outlet that is live;
2. the power/volume switch on the display panel is pulled all the way out to the ON position;
3. the fuse has not blown.

Note: See Section 2.9 for a full discussion of the power supply circuits and how to test them.

(f) Display Related Failure:

The display circuit board does not have built-in circuit test points, nor is it easily accessible. If the displays show such trouble symptoms as to blurred or incorrect characters, and these cannot be related to the failure of the other circuits, consult Northeast Electronics Customer Service Center for what action to take.

(g) Circuit Board Related Failure:

If a preliminary check indicates no external, power, or display-related failure, then the problem is likely in one of the measuring circuit boards: the I/O Board, the VF Board, or the Processor Board. A functioning spare or backup set of the three boards can be used to further isolate the source of the problem. Disassemble the Model 1125 and swap the boards one at a time, the spare in place of the installed board.

Note: Be careful not to mix up the spare-board and the installed board. To prevent this, put a temporary mark on one of them before swapping.

Each time a spare board is swapped for an installed board, run the Model 1125 through the operations that previously failed. If the Model 1125 no longer malfunctions, it is apparent the installed board has failed. In that case, see the instructions below for performance testing.

Note: Instructions for disassembling the Model 1125 can be found in Section 2.2 of this manual.

If spare circuit boards are not available, or if the board swapping step is skipped, immediate separate performance tests can be conducted on each board. These tests also require disassembly of the Model 1125.

2.1.1 TROUBLESHOOTING GUIDE

2.1.2 General

Although products manufactured at Northeast Electronics are warranted for 3 years (as of 9/1/87), occasional problems may arise which require instrument evaluation and servicing. Problems which may arise can generally be classified into one of the following groups:

(a) *Misunderstanding* on the part of the user concerning design intent, implementation of functions, or instrument features.

(b) *Calibration issues* in which periodic calibration and maintenance are required.

(c) *Functional problems* in which the unit or part of the unit is not operating.

2.1.3 User Misunderstanding

The user of the Model 1125 should become familiar with the unit by studying the Installation & Operations Manual (part number A 1125 00 600) which is provided with each unit. This manual provides clear explanations of the use of all functions, with definitions, examples of usage, and specifications. Questions concerning use of the instrument may be directed to your Sales Engineer or Northeast Electronics.

2.1.4 Calibration Issues

The instrument is basically composed of five assemblies: Display, Processor, V/F, I/O, and Power Supply. Full information concerning testing of these assemblies are referenced in the Table of Contents. Each assembly includes a functional description, schematics, parts lists, recommended test equipment list, and calibration or testing procedures.

2.1.5 Functional Problems

When functional problems occur, the following general steps should be taken:

(a) Carefully inspect the unit for damage suffered due to mishandling or inappropriate environments.

(b) Following procedures outlined in Section 2.2, disassemble the unit and look for obvious problems such as loose parts, damaged or pinched wiring, and loose connectors.

(c) When available, a stock of known good spare subassemblies can be used to quickly isolate a problem, by simply exchanging known good boards for questionable assemblies until the problem is resolved.

(d) Refer to specific symptoms in Table 1.1, Troublehooting Guide, to match symptoms against probable causes and remedies. Further information concerning circuit theory, component location, and testing can be found in this table.

(e) It is recommended that any user attempting to repair or service a Model 1125 contact the Service Department for further information. Such a call might avoid return of the instrument and further time out of service.

(f) Reassemble the unit following procedures outlined in Section 2.2.3.

(g) Confirm problem solution by performance testing the instrument, as described in Section 2.4.

(h) If the instrument must be returned to Northeast Electronics, please follow the procedure outlined in Section 2.1.2, which will insure the most efficient response practical.

TABLE 2.1-A TROUBLESHOOTING GUIDE

SYMPTOM	PROBABLE CAUSE AND REMEDY
Displays blank, blurring, incorrect	Power supply problem. Insure proper power cord connection. Insure proper power supply. With power cord disconnected, check integrity of fuse and replace if necessary. Refer to Section 2.9 for information concerning the Power Supply, including description, layouts, block diagrams, access, and testing information.
Batteries do not hold full charge	Contact Northeast Electronics Service Department.
Failed Self Test #1	Problem with reading of or with accuracy of 10 volt reference on Processor Board. Refer to Section 2.6 for more information concerning the Processor Board.
Failed Self Test #11	Problem with Impulse Noise Measurement; failure of Processor and/or I/O Boards. Refer to Section 2.6 for more information concerning the Processor Board. Refer to Section 2.8 for more information concerning the I/O Board.
Failed Self Test #12	Probable Cause: Problem with P/AR measurement; failure of Processor, V/F and/or I/O Boards. Refer to Section 2.6 for more information concerning the Processor Board. Refer to Section 2.7 for more information concerning the V/F Board. Refer to Section 2.8 for more information concerning the I/O Board.
Failed Self Test #20	Problem with TMS measurement; failure of V/F and/or I/O Boards. Refer to Section 2.7 for more information concerning the V/F Board. Refer to Section 2.8 for more information concerning the I/O Board.
Failed Self Test #22	Problem with C-Message Filter; failure of V/F and/or I/O Boards. Refer to Section 2.7 for more information concerning the V/F Board. Refer to Section 2.8 for more information concerning the I/O Board.

Table 2.1-A
TROUBLESHOOTING GUIDE (cont)

SYMPTOM	PROBABLE CAUSE & REMEDY
Failed Self Test #23	Problem with 3-kHz Filter; failure of V/F and/or I/O Boards. Refer to Section 2.7 for more information concerning the V/F Board. Refer to Section 2.8 for more information concerning the I/O Board.
Failed Self Test #24	Problem with 15-kHz Filter; failure of V/F and/or I/O Boards. Refer to Section 2.7 for more information concerning the V/F Board. Refer to Section 2.8 for more information concerning the I/O Board.
Failed Self Test #25	Problem with PROG Filter; failure of V/F and/or I/O Boards. Refer to Section 2.7 for more information concerning the V/F Board. Refer to Section 2.8 for more information concerning the I/O Board.
Failed Self Test #26	Problem with 50 kBit Filter; failure of V/F and/or I/O Boards. Refer to Section 2.7 for more information concerning the V/F Board. Refer to Section 2.8 for more information concerning the I/O Board.
Failed Self Test #27	Problem with 1004 Hz Notch Filter; failure of I/O Board. Refer to Section 2.8 for more information concerning the I/O Board.

2.1.6 Fuses

The AC power input is protected by a 1/2 amp. slow-blow fuse located on the lower left corner of the instrument rear panel. To check or replace a fuse, insert a small, flat-bladed screwdriver in the slot of the holder. Push lightly on the fuseholder and rotate a quarter of a turn in direction of arrow marked on the holder. Pull off the unlocked holder top with your fingers and remove the fuse from inside the top. Clips on the rear panel allow storage of two spare fuses.

Note: If the fuse filament is broken or melted, replace it with another of the same type and rating (3 AG, 250 volt, 1/2 amp, slow-blow).

2.1.7 Battery Replacement

The Model 1125 can be operated from either the internal battery pack or from an external AC power source.

Note: The test set cannot be operated in the battery mode while connected to an external AC power source.

Units equipped with the dc power option operate on 115 Vac 60 Hz, with a battery back-up system. If the unit is connected to an AC outlet, the battery is charging. The Model 1125 may be used on battery power for up to 3.5 hours. A low battery indicator on the front panel, a small red LED next to the POWER SWITCH, indicates operational time is limited to 15 to 30 minutes and that the unit should be connected to AC power to fully charge the battery.

(a) If the unit must be left on while charging, it will only receive a trickle charge.

(b) With the unit turned off, the battery will be fully charged in approximately 16 hours.

****
*
* - DANGEROUS VOLTAGE PRESENT -
*
* - Take Necessary Precautions To Preclude Injury -
*
*
****

(c) If the batteries do not hold a charge or fail to operate for up to 3.5 hours, then it is an indication that the batteries need to be replaced. Prior to returning a product for factory service, call our Customer Service Center to obtain a Return Material Authorization (RMA) Number at (603) 228-3700. Return products directly to our Service Center in Concord, New Hampshire with a description of the problem. Include all of the following information:

- Purchase Order Number
- Bill-to address
- Ship-to address
- Description of problem

2.1.8 Preparation for Reshipment

The following pre-packaging preparation and packaging procedure is designed to assure safe conveyance of the instrument via aircraft or closed van in a normal commercial shipping environment. If the package is going to be exposed to the elements or transported over extremely rough terrain, additional special packaging will be needed.

Preparation:

1) Set the instrument's power switch to the OFF position.

2) Unplug the instrument from the AC power source.

3) Neatly coil the power cord and place it in the bottom compartment of the instrument's cover assembly.

4) Close and lock the front cover.

5) Wrap the instrument handle with a protective padding (i.e., plastic bubble pack, etc.) to prevent the handle from scratching the top of the instrument.

6) If the instrument is being returned to the factory for repair, place a tag on the unit describing the problem and the name, address and phone number of the person to contact regarding the repair.

2.1.9 Packaging:

The preferred reshipment packaging is the re-use of the factory shipping container with the formed foam padding. If that is not available the following packaging procedure should be used.

1) Place the instrument in the appropriate size plastic bag and seal the bag using adhesive tape, staples, twist wrap, etc.

2) Place the bag containing the instrument in a 3/16-inch (4.762 mil), double-wall, corrugated cardboard box that is at least 2 inches (but not more than 6 inches) larger in all dimensions than the outside dimensions of the instrument.

3) Fill the (2 inch min.) spaces between all sides of the instrument and the inside walls of the container with a good commercial grade shock absorbing padding material such as bubble pack, "pop corn" styrofoam filler, etc.

4) Seal the box using a good commercial grade reinforced packaging tape.

5) Mark all sides of the container with large lettering saying "ELECTRONIC INSTRUMENT - HANDLE WITH CARE".

6) If the reshipment is a factory repair address the box as specified earlier in this manual.

2.2 DISASSEMBLY AND REASSEMBLY

2.2.1 Scope:

This section explains how to disassemble the Model 1125 for the purpose of calibrating, making repairs, or sending a component to Northeast Electronics Repair Department for repair or replacement. In addition, it explains how to reassemble the Model 1125.

A. Disassembly

2.2.2 Model 1125 Disassembly Steps:

To disassemble the Model 1125, follow the procedure given below.

> **WARNING:** Turn the Model 1125 power switch OFF and disconnect its power cord from the 115 Vac power receptacle before starting any disassembly work.

1. Rear Bezel. Take off the rear bezel by first removing the two nuts holding it to the chassis rear panel and then sliding it off the chassis and past the AC power cable (Figure 2-1).

*2. **Top and Side Panels.*** Slide out (and to the rear) the top panel and the two side panels of the chassis (Figure 2-1).

*3. **Front Panel Subassembly.*** In order to release the front panel subassembly from the chassis, remove the two screws near the front of each side (Figure 2-2).

Note: Notice orientation of plugs prior to removal

4. Two cable clusters go from the front to the rear panel. One has a 4-pin plug and the other has a 5-pin plug, going to the power supply. Disconnect these white plastic plugs on the inside rear panel by lifting the locking tab and pulling the connector straight out (Figure 2-5).

5. Slide the front panel out part way from inside the front bezel by pushing against the rear of the front panel with both thumbs while gripping the sides of the bezel with the fingers and palms of both hands. (The front panel and three circuit boards extending from it should start to slide straight out.) See Figure 2-3.

CAUTION: While removing the front panel and circuit board assembly, support the weight of the front panel to avoid placing any stress on the circuit boards.

6. While gripping and supporting the sides of the front panel with both hands, push back the corners of the top circuit board with both thumbs to disconnect this board (the processor board) from the front panel (Figure 2-3). Repeat this procedure for the middle board (the V/F board).

7. Pull the front panel all the way out of the frame with the bottom circuit board (I/O board) still attached (Figure 2-4).

8. Remove the two screws holding separate ground wires to the inside back of the front panel (the mother board). See Figure 2-4.

9. On the front panel, remove the tiny screw holding the TRANSMIT dial to the dial shaft, and pull off the dial. Do the same for the RECEIVE dial.

*10. **I/O Board.*** Carefully pull the I/O board out of its slot on the mother board. With the I/O board removed from its slot, the front panel assembly will consist of the display circuit board and the front panel. The visible side of the display circuit board, with its long slots, functions as the Model 1125 mother board. The display board components are mounted on the other side.

Note: Do not disassemble further unless access to the power supply, transformer, or battery is needed. Do not try to separate the display board and the front panel, because of the complicated connections (See Display Board and Front Panel).

*11. **Rear Panel.*** Disconnect the two-pin battery connector (J13) from the power supply board (Figure 2-5).

12. Remove the four flathead screws (RPS) located at the corners of the outside rear chassis panel (Figure 2-6) and lift off the rear panel.

*13. **Power Supply Circuit Board.*** If access to the power transistors is needed, the power supply circuit board may be moved out of the way by removing the four panhead screws (PSS) on the exterior side of the rear panel (Figure 2-6).

Note: Do not try to disconnect the power supply circuit board completely. To do so, about two dozen wires would have to be disconnected and later reconnected in the right order.

*14. **Transformer.*** To remove the transformer from the rear panel, first disconnect the three wires going from the transformer to E1, E2, and E3 on the right edge of the power supply board (Figure 2-7).

15. Then remove the four panhead screws (TRS) holding the transformer to the rear panel (Figure 2-6).

*16. **Battery.*** To take out the battery, remove the three panhead screws (BAS) that fasten the sheet-metal bracket holding the battery in place. (One screw is on the inside of the side panel and two screws are on the chassis divider panel. See Figures 2-5 and 2-6.)

B. Reassembly

2.2.3 Model 1125 Reassembly Steps

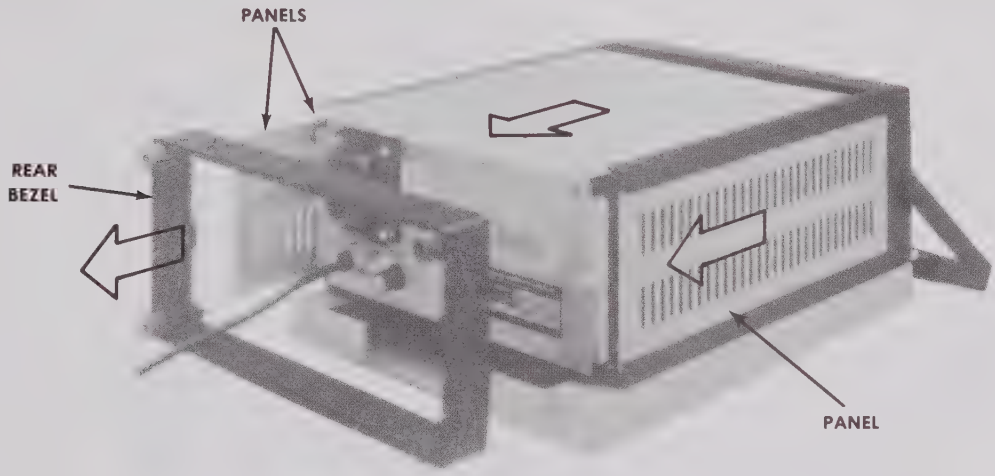


Figure 2-1 Removing the 1125 Rear Bezel and Panels

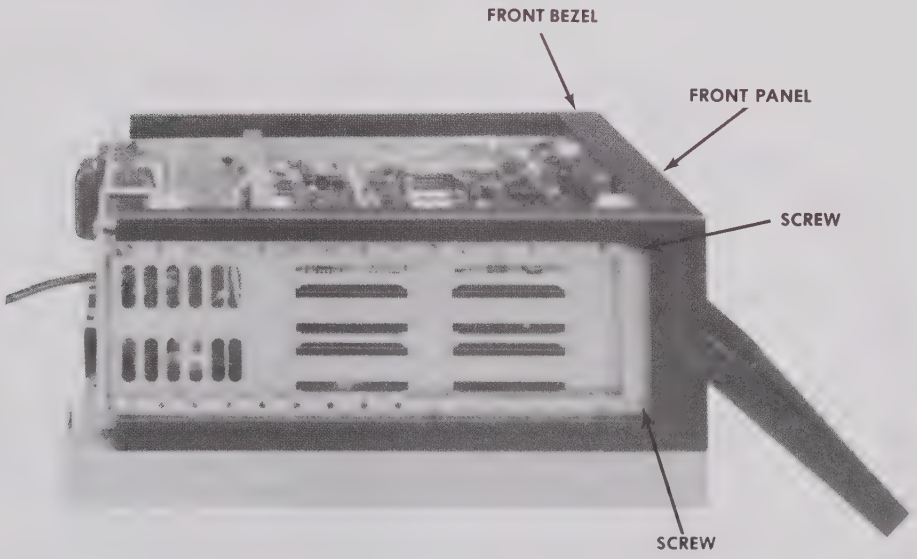


Figure 2-2 Releasing the Front Panel

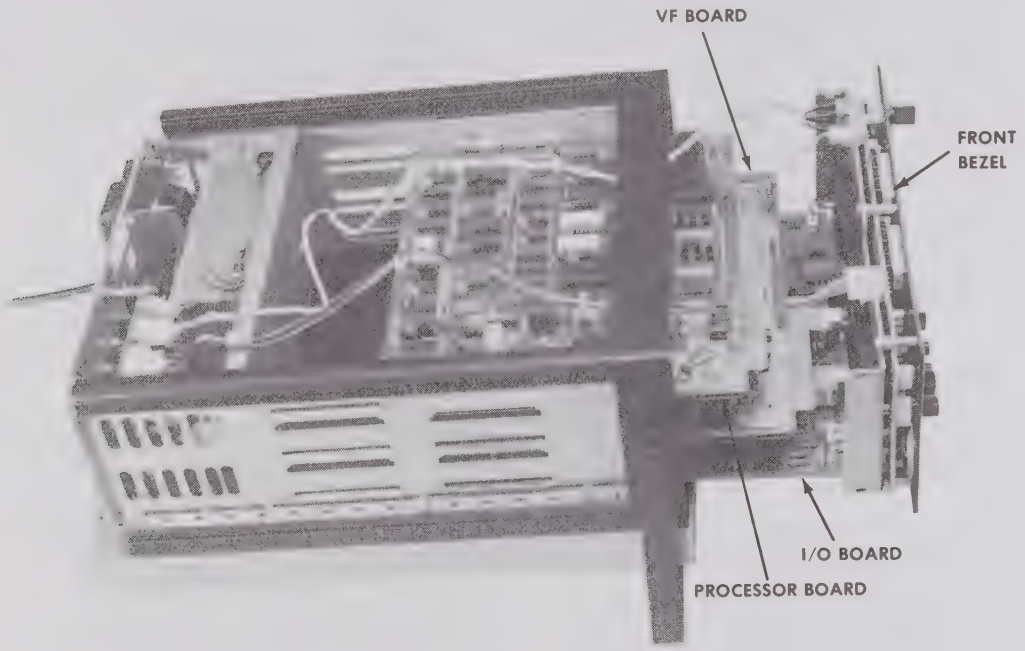


Figure 2-3 Disconnecting the Processor and V/F Boards

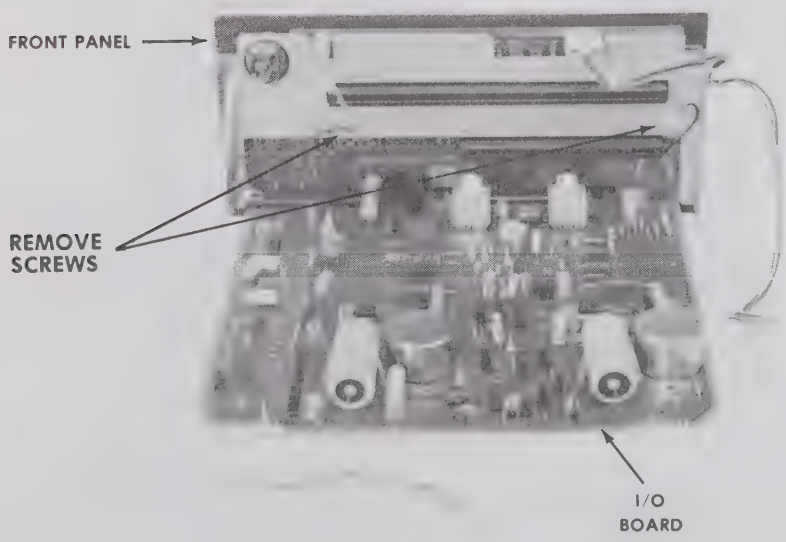


Figure 2-4 Removing the Front Panel and I/O Board

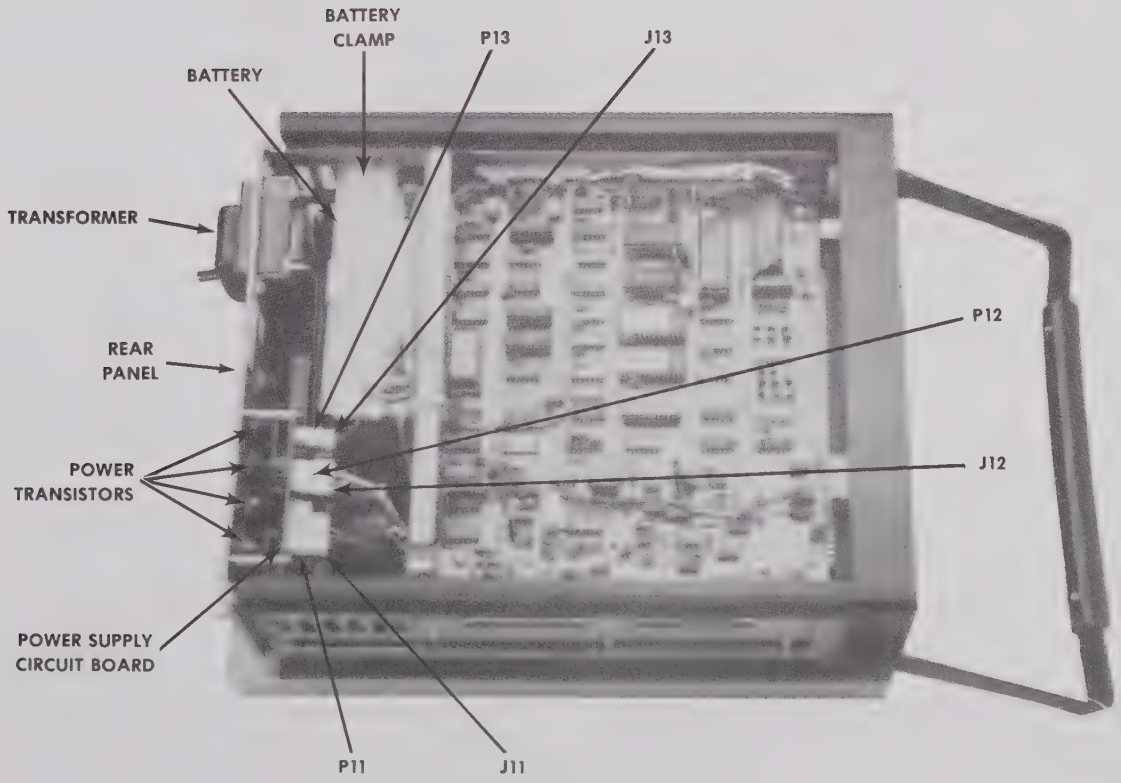


Figure 2-5 Power Supply (Inside Rear Panel View)

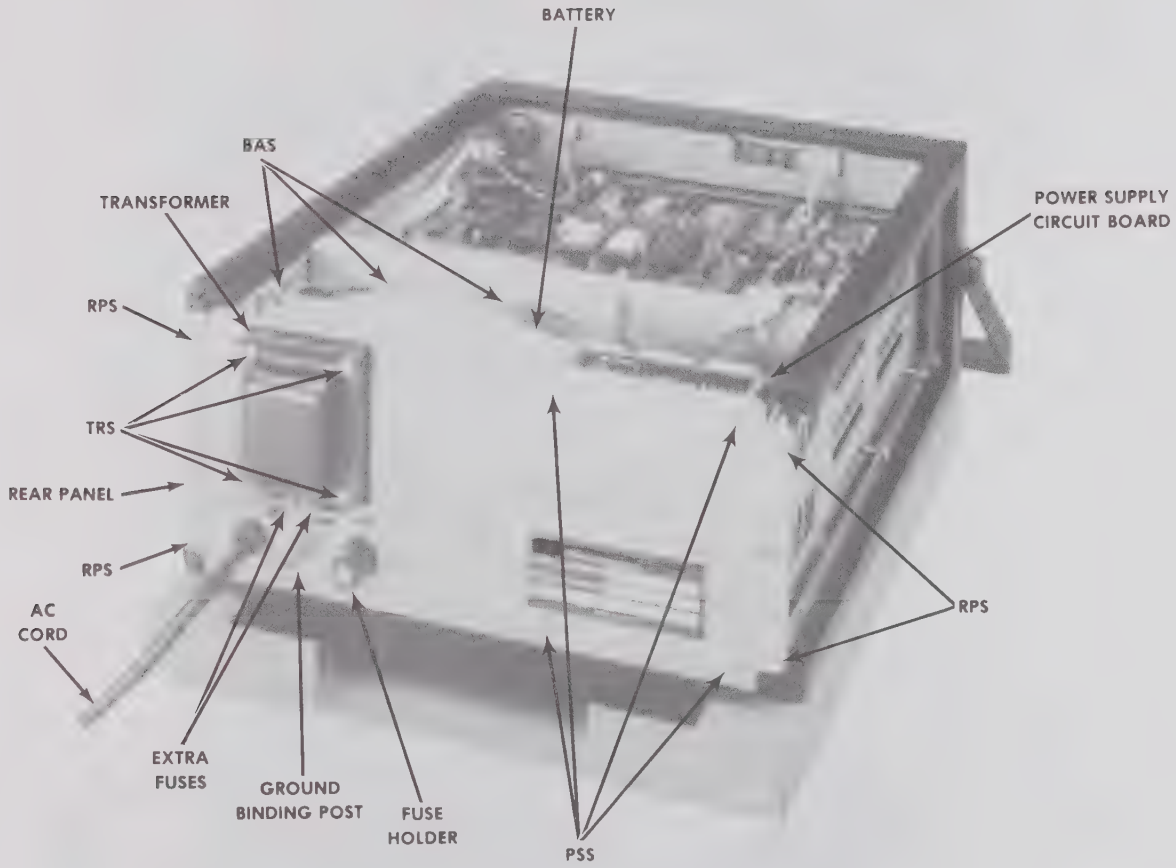


Figure 2-6 Power Supply (Outside Rear Panel View)

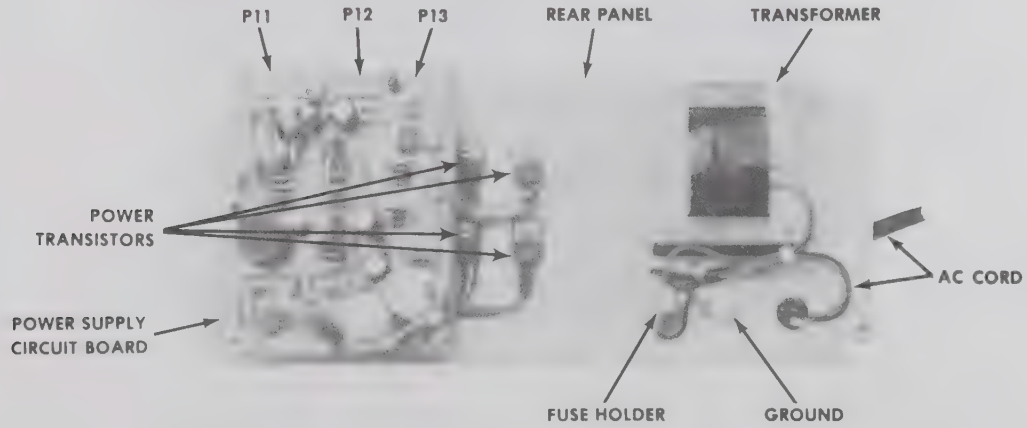


Figure 2-7 Inside Rear Panel Detail

Following any repair or replacement of a component, carry out the procedure below for reassembly of the Model 1125 Transmission Test Set. Use the assembly set of illustrations as a guide.

WARNING: Turn the Model 1125 power switch OFF and make sure the power cord is not connected to the 115 VAC power receptacle before starting any assembly work.

1. Battery. To reinstall the battery, after replacing it in its space, refasten the sheetmetal bracket with the original three panhead screws (BAS) as illustrated in Figures 2-5 and 2-6.

2. Transformer. To reinstall the transformer, refasten it with the original four flathead screws (TRS) coming from the outside of the rear panel (Figure 2-6). Then reconnect the transformer wire connectors to the three pins on the right edge of the power supply circuit board (Figure 2-7).

3. Power Supply Circuit Board. To reinstall the power supply board, use the four original panhead screws (PSS) to refasten it to the inside rear panel (Figure 2-6).

4. Rear Panel. To reinstall the rear panel, hold the board against the inside rear panel and reinsert the four original flathead screws (RPS) as illustrated in Figure 2-6.

5. Reconnect the two-pin battery connector (J13) to the power supply board (Figure 2-5).

6. I/O Board. Reinsert the I/O board in the bottom slot of the mother board, and replace the TRANSMIT and RECEIVE dials using their tiny set screws to fasten them to their shafts. Make sure they are properly aligned with the front panel markings.

7. Refasten the two ground wires to the mother board (Figure 2-4).

8. V/F Board and Processor Board. With the face of the front panel facing down on a soft work surface, reinsert the V/F board in the middle slot and the Processor board in the top slot of the mother board. (Figure 2-4)

9. Front Panel Subassembly. Carefully slide the circuit board and front panel assembly back into the Model 1125 frame, making sure the two cable clusters leading from the mother-board also go through the front opening of the frame (Figure 2-3).

10. Refasten the two cable cluster connectors to their corresponding pin connectors on the back inside of the rear panel(Figure 2-3). (Push the connectors straight in so that the pins will not be bent or broken.) Note that one connector is a 4-pin and one is a 5-pin connector; this will indicate where each one goes.

11. Replace the two screws on each side that holds the front panel to the frame (Figure 2-2).

12. Side and Top Panels. Slide the top and side panels back into their slots in the frame (Figure 2-1).

13. Rear Bezel. Slide the rear bezel back over the AC power cable and on the frame and fasten it to the frame with a nut over each of the two protruding fixed bolts (Figure 2-1).

14. Now turn the Model 1125 power switch ON in order to let the set run through its self-test routine. If any of these automatic tests fail, make a note of any indicated failure, and go to the troubleshooting section of this manual.

2.3 OVERALL THEORY OF OPERATION

2.3.1 Scope:

This section briefly introduces the basic theory governing the design of the Model 1125 Transmission Test Set, including the theory of:

- overall test set functions
- impulse noise of a signal and its measurement
- P/AR (peak-to-average-ratio) of a signal and its measurement

Specific circuit boards are discussed in later topics.

A. Overall Test Set Functions

2.3.2 Description:

The Model 1125 Transmission Test Set is a multifunction instrument designed for measuring signal transmission impairment with V/F, Program, and wideband telecommunications circuits. A user can send a calibrated test signal while simultaneously measuring frequency and level of tone or noise. With two digital LED displays showing alphanumeric characters, and

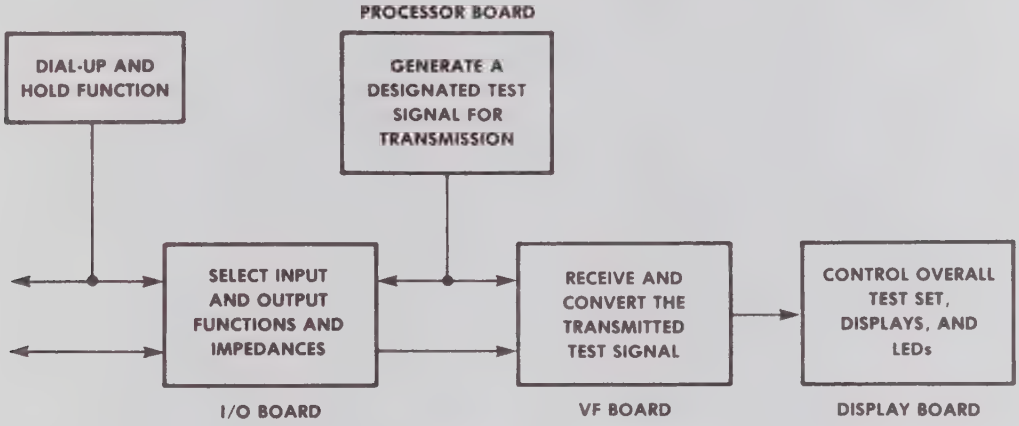

PROCESSOR BOARD
DIAL-UP AND HOLD FUNCTION
GENERATE A DESIGNATED TEST SIGNAL FOR TRANSMISSION
SELECT INPUT AND OUTPUT FUNCTIONS AND IMPEDANCES
RECEIVE AND CONVERT THE TRANSMITTED TEST SIGNAL
CONTROL OVERALL TEST SET, DISPLAYS, AND LEDs
I/O BOARD
VF BOARD
DISPLAY BOARD

Figure 2-8 Simplified Block Diagram of the Model 1125 Test Functions

with an audio feature, the user can monitor the level and frequency of both the received and the transmitted signal. The following paragraphs are a functional description of how the Model 1125 works. See Figure 2-8 for a simplified block diagram of the Model 1125 test functions. Each blocked function roughly corresponds to one of the circuit systems of the Model 1125. The details of each circuit system can be found in separate sections later in the manual.

2.3.3 Input and Output Functions:

Two front panel input/output sets of terminals (with one jack and two binding posts each) allow the user to test signals generated by the oscillator (output) and make measurements on received signals (input). Designated A or B, either terminal set may be used for input or output. The actual direction of transit and receive is controlled with a front panel switch. A nearby switch and dial allow testing in a terminated mode, as well as selection of the terminating resistance desired. Or the bridging mode may be selected in order to receive at high input impedances. Either terminal set provides a dial-and-hold circuitry for holding a direct current dial-up line. This circuitry simulates an "off-hook" condition for the dialed line. The circuitry for selecting input and output functions, as well as impedances, is found on the I/O circuit board.

2.3.4 Receive Functions:

The receive circuits process the input signal or the transmit signal for use by the display and controller circuits. The receive circuits contain a microprocessor controlled auto-range network to range both the frequency and level of the signal. The receive circuitry is found on the V/F circuit board.

2.3.5 Transmit Functions:

The transmit oscillator generates the calibrated test signals. These signals are applied to the selected output terminal and to the receive circuit. The transmit circuitry is found on the Processor circuit board.

2.3.6 Controller and Display Functions:

Using digital signals, the controller directs the overall operation of the equipment. The display provides digitally controlled LED readings of the measurement information from the receive circuit. The readings appear in two four-digit displays, showing standard signal and noise measurement for impulse noise and P/AR (Peak-to-Average Ratio). Noise is measured in dBm and P/AR. In addition, 44 LED lamps selectively indicate the function or functions being used currently. The controller and display circuitry is found on the display circuit board, which also functions as the mother board interconnection of all the circuit boards.

B. Impulse Noise Theory

2.3.7 Impulse Noise:

Noise bursts or spikes that are much higher than normal peaks of background noise or noise-with-tone are called impulse noise. Impulse noise is best defined as that component of a received signal that has been band-limited and exceeds the RMS noise level in the same band by 12 dB or more.

2.3.8 Measurement:

The Model 1125 allows measurement of the amplitude distribution of the spikes exceeding various thresholds for a given period of time. An impulse noise measurement is made by counting the number of spikes that exceed a pre-established threshold. Because measurement is done in the presence of a 1004 Hz holding tone, C-Message weighting and notch 1010 Hz filters are selected to bandlimit the signal in the receive circuitry. Figure 2.9 illustrates a received holding tone (or test signal) that includes interfering impulse noise.

2.3.9 Thresholds:

The Model 1125 user can select the lowest, or REFERENCE, threshold level in steps of 1 dB, from 30 dBrn to 110 dBrn for balanced signals and from 60 dBrn to 140 dBrn for impulse noise-to-ground measurements. The MID threshold is automatically set to 4 dB above the REFERENCE threshold, and the HI threshold is automatically set to 8 dB above the REFERENCE.

2.3.10 Time:

The Model 1125 has set time periods for counting impulse noise. Using the keypad, the user selects 5, 15, or 60 minutes, or CONT (continuous) time. Because impulse noise is a random phenomenon, a longer measurement period will yield more reliable data. The count may be manually terminated at any time by pressing the START/STOP key. During counting, the Model 1125 right display will show the number of spikes above a given threshold, and a front panel LED lamp will indicate which threshold level is being dis-

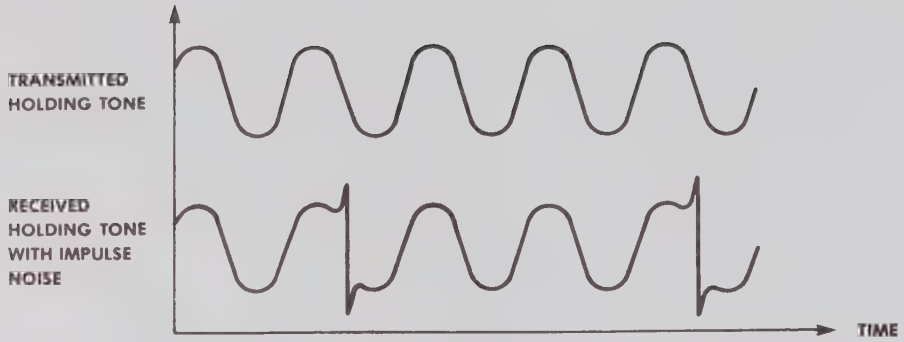


Figure 2-9 Visual Representation of Impulse Noise

played (REF, MID, or HI) according to the display option chosen. If a time period of 60 minutes or longer is selected, the worst continuous 15-minute period will be stored and the user can later recall it along that period's start time.

2.3.11 Blanking:

Large noise spikes may cause oscillation or "ringing." When this occurs the user must disable the counter for a period of time after a hit to prevent counting the same spike more than once.

C. P/AR THEORY

2.3.12 P/AR Function:

Channel dispersion is the spreading in time of signal amplitude. To measure channel dispersion caused by transmission imperfections, the user generates and measures,using P/AR, a pulse train of known spectral content. P/AR provides a means of quickly comparing channels with acceptable and unacceptable phase characteristics.

2.3.13 Content of Pulse Train:

The spectral content of the transmitted pulse train is representative of a data-modulated voice-band signal. The components are chosen to give rise to a high signal peak to a full wave rectified average of the signal, called the peak-to-average ratio or P/AR. The spectrum of the transmitter output consists of 16 components at frequencies of

$$f_n = (2n - 1)\ 125 + 15.625\ Hz$$

where n = 1,2,...16. Note the absence of even harmonics. This produces a pulse train with half-wave symmetry, which minimizes the influence of system nonlinear distortion on the P/AR measurement.

2.3.14 P/AR System:

The P/AR system consists of a receiver and a transmitter connected to opposite ends of a voice-band transmission system. The ratio of the absolute peak and full wave rectified average values are measured on a zero-suppressed scale and displayed. This ratio is a basis for the P/AR rating.

2.3.15 P/AR Rating:

The P/AR rating is calculated as follows:

$$P/AR = 100\ [\ 2 - \frac{Ep}{E_f} - 1]$$

where Ep = the normalized absolute peak value of the pulse train and Ef = the normalized full-wave rectified value of the pulse train A P/AR reading of 100 signifies no pulse degradation.

2.3.16 Dispersion:

As the P/AR signal travels through a dispersive medium, the P/AR will deteriorate. If the primary cause of dispersion is phase nonlinearity, the P/AR reading provides a quick measurement of this impairment. Other degradations of the signal also affect the P/AR rating but to a lesser extent. In order of importance, they are the following:

- frequency response
- frequency nonlinearity
- C-Notched Noise
- incidental frequency modulation

2.3.17 Acceptable Ratings:

P/AR ratings of 50 or higher indicate acceptable levels of intersymbol interference for medium speed (2400 baud) data transmission.

2.3.18 P/AR Transmission:

Refer to the Processor board for a further discussion of the P/AR transmitter circuitry.

2.4 PERFORMANCE TESTING THE MODEL 1125

2.4.1 Scope:

After calibration, use these procedures for testing the Model 1125 any time the set does not function properly.

2.4.2 Test Equipment:

Table 2.4-A lists the equipment needed.

Note: All test equipment references and illustrations in this manual are to the recommended manufacturer's models listed in Table 2.4-A. If a different make or model is used, the action taken at any given step in a procedure may be a little different than the step described here.

2.4.3 Self-Test:

Before starting the performance test series, turn ON the Model 1125 power switch and make note of any failure messages that are displayed while the Model 1125 self-test routine is running. These self-test messages are explained in the Appendix (Section 4.0).

2.4.4 Test Procedure:

There are several tests used to check the performance of the Model 1125. Each test comprises three stages. In the first stage, the equipment is set up or the setup is changed with the necessary cable connections. In the second stage, the necessary dial or switch settings on the test equipment are made, and the proper functions of the 1125 entered using the keypad. In the third stage, the settings are changed and the resulting displayed value is compared each time with the standard specified value. Changes of setting and standard specification values are printed in table format.

2.4.5 Test Follow-up:

If the result of a particular test or test series does not conform to the standard, run the same test again. Make sure the cable setup and dial or switch settings are correct. If the Model 1125 fails the test a second time, make a note of the failure, including the erroneous result, and complete the remaining performance test. Call Northeast Electronics Customer Service to describe the test failure and get assistance.

TABLE 2.4-A
TEST EQUIPMENT NEEDED FOR PERFORMANCE TESTING

EQUIPMENT	RECOMMENDED MAKE
Alternating Current Calibrator	Fluke 5200A Programmable AC Calibrator
Frequency Counter (80 MHz)	Hewlett-Packard 5381A or its equivalent
Attenuator	General Radio 1450 Decade Attenuator
Transmission Test Set	Northeast Electronics Model 1122B
Shorted Tip-and-Ring Plug Butt-In Telephone Handset	DRACON TS21-20
Cables	Test Cable with a Dual-Banana Plug and Single 310 Plug
	Test Cable with Single 310 Plug and Two Alligator Clip Leads
	Test Cable with Single 310 Plug at Each End
	Standard Telephone Patch Cord with Single 310 Plug and RJ11 Modular Phone Plug

A. RECEIVER ACCURACY AT 1.004 kHz

2.4.6 Objective:

This test checks the accuracy of the receiver function by observing the dBm level at varying voltages and impedances.

2.4.7 Equipment:

This test requires the following equipment:

- Fluke 5200A Programmable AC Calibrator or equivalent
- Test cable with a dual-banana plug and a single 310 plug

2.4.8 Setup:

Make the following equipment setup:

(1) Insert the dual banana plug of the cable in the calibrator OUTPUT jacks, with the ground prong in the LO jack.

(2) Insert the 310 plug in the 1125 A pair jack.

2.4.9 Initial Settings:

This test requires the following initial dial or switch settings:

(1) To get the REC A, TRAN B mode, push the 1125 TRANSFER switch to the out position, if it is not out already.

(2) Set the 1125 RECEIVE dial to 600 ohms.

(3) Set the BRIDGE/TERM pushbutton switch to the TERM (IN) position.

(4) ENTER [14] on the 1125 keypad so that measurements on the receive side of the circuit will be displayed. The REC LED should light.

(5) Set the AC calibrator to 0.774596 volts RMS at 1.004 kHz.

(6) Check to verify that the 1125 left display reads 0.0 + 0.1 dBm.

2.4.10 Test:

To test for receiver accuracy at 1.004 kHz, do the following:

(1) Change the AC calibrator voltage readings one at a time through the series listed in the first column of Table 2.4-B.

(2) For each voltage reading, check the 1125 left display to see if the dBm level reading agrees with the specification level in the second column of the same table.

TABLE 2.4-B
RECEIVER ACCURACY TEST

VOLTAGE LEVEL AC RMS (Calibrator Setting)	dBm RESULT (1125 Left Display)
0.774596 V	0+0.1 dBm
0.07746 V	-20+0.1 dBm
0.007746 V	-40+0.1 dBm
0.002449 V	-50+0.1 dBm*
0.02449 V	-30+0.1 dBm
0.2449 V	-10+0.1 dBm
2.449 V	10+0.1 dBm*
0.87918 V	1.1+0.1 dBm
0.99788 V	2.2+0.1 dBm
1.1326 V	3.3+0.1 dBm
1.2855 V	4.4+0.1 dBm
1.4591 V	5.5+0.1 dBm
1.6561 V	6.6+0.1 dBm
1.8796 V	7.7+0.1 dBm
2.1334 V	8.8+0.1 dBm
2.4217 V	9.9+0.1 dBm

*Note: -50.1 is Under Range (Ur).
10.1 is Over Range (Or).

B. RECEIVER FREQUENCY RESPONSE AT 0.0 dBm

2.4.11 Objective:

This test checks receiver frequency by observing dBm level tolerances at varying voltages.

2.4.12 Equipment:

No change from previous test.

2.4.13 Setup:

No change from previous test.

2.4.14 Initial Settings:

This test requires the following initial dial or switch settings:

(1) Keep the 1125 TRANSFER switch set to the REC A, TRAN B mode.

(2) Reset the Model 1125 RECEIVE dial to 600 ohms.

(3) Set the AC calibrator to 0.774596 volts RMS at 1.000 kHz.

(4) Check to verify that the 1125 left display reads 0.0 dBm at 1.000 kHz.

(5) Check to make sure the REC LED is still on. If not, ENTER [14] on the 1125 keypad.

2.4.15 Test:

To test for receiver accuracy at 1.004 kHz, follow this procedure:

(1) Change the AC calibrator frequency settings one at a time through the series listed in the first column of Table 2.4-C.

(2) For each frequency setting, check the Model 1125 left display to see if the dBm level reading agrees with the specification tolerance level listed in the second column of the same table.

TABLE 2.4-C
RECEIVER FREQUENCY RESPONSE TEST

FREQUENCY (Calibrator Setting)	dBm TOLERANCE (1125 Left Display)
0.040 kHz	+/-0.3 dBm
0.100 kHz	+/-0.3 dBm
1 kHz	+/-0.1 dBm
10 kHz	+/-0.1 dBm
15 kHz	+/-0.3 dBm
50 kHz	+/-0.3 dBm
100 kHz	+/-0.5 dBm
110 kHz	+/-0.7 dBm

C. IMPULSE NOISE STATUS

2.4.16 Objective: This test checks the accuracy of the impulse noise level at which the Model 1125 begins counting hits above the threshold.

2.4.17 Equipment:

No change from previous test.

2.4.18 Setup:

No change from previous test.

2.4.19 Initial Settings:

This test requires the following initial dial or switch settings:

(1) No changes in the 1125 TRANSFER switch and RECEIVE dial settings.

(2) Set the calibrator to 0.774596 volts RMS at 1.800 kHz.

2.4.20 Test:

To test the impulse noise status, carry out the steps in the first column of Chart 2.4-A and make a note if any of the specified results in the second column do not occur.

2.4.21 Reset the Units:

Before going on to the next test, reset the Model 1125, following these steps:

(1) ENTER [10] on the 1125 keypad. TMS LED lights.

(2) ENTER [20]. LEVEL dBm LED lights.

(3) ENTER [10]. TMS LED lights.

This selects the dBm level in the TMS measurement mode.

CHART 2.4-A
IMPULSE NOISE STATUS TEST

STEP	ACTION	RESULT
1	ENTER [11].	IMP N LED LIGHTS
2	ENTER [42]. Type 92 on 1125 keypad.	REF SET LED lights. Sets impulse noise reference level to 92 dBrn.
3	Press START/STOP button on keypad.	COUNT LED lights and 1125 does not count.
4	Type 91 on keypad.	Decreases noise reference level by 1 dB.
5	Press START/STOP button.	COUNT LED lights and set starts counting.
6	Pull the calibrator cable from 1125 A pair jack.	1004 Hz LOSS LED lights and set stops counting.
7	Reinsert the 310 plug in the 1125 A pair jack.	1004 Hz PRES LED lights.
8	ENTER [44] on 1125 keypad.	1004 Hz LOSS RESET LED out.
9	Press START/STOP button.	1125 stops counting.
10	ENTER [49].	10ms BLANK LED lights. This program function disables counting for 10 milliseconds after a hit.
11	Repeat steps 2–9, above.	Checks to see that counting works when it is speeded up using the disable function.

D. NOISE-TO-GROUND

2.4.22 Objective:

This test checks the dBrn noise level when the Model 1125 noise-to-ground function is selected,

2.4.23 Equipment:

This test requires the following equipment:

- Fluke 5200A Programmable AC Calibrator or its equivalent
- Shorted tip-and-ring plug
- A test cable with a dual-banana plug and alligator clip lead at one end and a single 310 plug at the other end.

2.4.24 Setup:

Make the following setup change from the previous test.

(1) Disconnect and temporarily set aside the cable used in the last test.

(2) Insert the high-side prong of a shorted tip-and-ring plug in the high-side jack of the AC calibrator OUTPUT.

(3) Clip the ground lead of the cable to the ground post next to the AC calibrator OUTPUT jacks.

(4) Insert the dual-banana plug of the same cable into the shorted tip-and-ring plug.

(5) Insert the 310 plug in the 1125 A pair jack.

2.4.25 Initial Settings:

For this test, make the following instrument settings:

(1) Set the AC calibrator to .774596 volts RMS at 1.000 kHz.

(2) Enter [21] on the 1125 keypad to select the noise-to-ground function. The N-G dBrn LED should light.

2.4.26 Test:

To test the noise-to-ground functions, do the following:

(1) Change the AC calibrator voltage output settings one at a time through the series listed in the first column of Table 2.4-D.

(2) For each voltage setting, check the 1125 left display to see if the dBrn level reading agrees with the specification level listed in the second column of the same table.

2.4.27 Restore 1125:

After completing this test, restore the 1125 ENTER [21], to cancel the Noise-to-ground measurements and check to seet that the N/G dBrn LED is OFF.

TABLE 2.4-D
NOISE-TO-GROUND TEST

VOLTAGE LEVEL AC RMS (Calibrator Setting)	NOISE-TO-GROUND (+1.5 dB) (1125 Left Display)
77.4596 V at 1 kHz	130 dBrn
7.74596 V at 1 kHz	110 dBrn
0.774596 V at 1 kHz	90 dBrn
0.0774596 V at 1 kHz	70+/-3 dBrn
0.00774596 V at 1 kHz	50 dBrn
0.774596 V at 1 kHz	Under Range (Ur)

E. C-MESSAGE FILTER

2.4.28 Objective:

This is the first of six filter tests. This test checks the noise-weighting effectiveness of the C-message filter measured by the dBrn level at varying frequencies.

2.4.29 Equipment:

This test and the remaining filter tests require the following equipment:

* Fluke 5200A Programmable AC Calibrator
* Test cable with a dual-banana plug and a single 310 plug.

2.4.30 Setup:

Make the following setup change from the previous test:

(1) Remove the dual-banana plug from the shorted tip-and-ring plug from in the calibrator.

(2) Also remove the shorted tip-and-ring plug from the calibrator and set it aside.

(3) Reinsert the dual-banana plug into the calibrator INPUT jacks, with the ground prong in the LO jack.

2.4.31 Initial Settings:

This test requires the following initial equipment offer program setting:

(1) Set calibrator to 0.774596 volts RMS at 1.000 kHz

(2) ENTER [22] on the 1125 keypad to select the C-message filter function. The CMSG LED should light.

2.4.32 Test:

To test the C-Message filter, follow this procedure:

(1) Change the AC calibrator frequency settings one at a time through the series listed in the first column of Table 2.4-E.

(2) For each frequency setting, check the 1125 left display to see if the dBrn level reading agrees with the specification level listed in the second column of the same table.

TABLE 2.4-E
C-MESSAGE FILTER TEST

FREQUENCY (Calibrator Setting)	dBrn EFFECT (1125 Left Display)	
0.060 kHz	34+2 dBrn	
0.300 kHz	73+1 dBrn	
0.700 kHz	87+1 dBrn	
1.000 kHz	90 dBrn	Reference
2.000 kHz	89+1 dBrn	
3.300 kHz	85+2 dBrn	
5.000 kHz	62+3 dBrn	
15.000 kHz	30 dBrn	Maximum

F. 3 kHz FILTER

2.4.33 Objective:

This test checks the noise-weighting effectiveness of the 3 kHz filter measured by the dBrn level at varying frequencies.

2.4.34 Equipment:

No change from previous test.

2.4.35 Setup:

No change from precious test.

2.4.36 Initial Settings:

This test requires the following initial program setting:

ENTER [23] on the 1125 keypad to select the 3 kHz filter function. The 3 kHz LED should light.

2.4.37 Test:

To test the 3-kHz Filter, follow this procedure:

(1) Change the AC calibrator frequency settings one at a time through the series listed in the first column of Table 2.4-F.

(2) For each frequency setting, check the 1125 left display to see if the dBrn level reading agrees with the specification level listed in the second column of the same table.

TABLE 2.4-F
3kHz FILTER TEST

FREQUENCY (Calibrator Setting)	dBrn EFFECT (1125 Left Display)	
0.060 kHz	90+1 dBrn	
0.400 kHz	90+1 dBrn	
1 kHz	90+1 dBrn	Reference
2 kHz	89+1 dBrn	
3 kHz	87+1 dBrn	
6 kHz	78+1 dBrn	
60 kHz	40 dBrn	Maximum

G. 15 kHz FILTER

2.4.38 Objective:

This test checks the noise-weighting effectiveness of the 15 kHz filter measured by the dBrn level at varying frequencies.

2.4.39 Equipment:

No change from previous test.

2.4.40 Setup:

No change from previous test.

2.4.41 Initial Settings:

This test requires the following initial program setting:

ENTER [24] on the 1125 keypad to select the 15 kHz filter function. The 15 kHz LED should light.

2.4.42 Test:

To test the 15 kHz filter, follow this procedure:

(1) Change the AC calibrator frequency settings one at a time through the series listed in the first column of Table 2.4-G.

(2) For each frequency setting, check the 1125 left display to see if the dBrn level reading agrees with the specification level listed in the second column of the same table.

TABLE 2.4-G
15 kHz FILTER TEST

FREQUENCY (Calibrator Setting)	dBrn EFFECT (1125 Left Display)
0.060 kHz	90+/-1 dBrn
0.400 kHz	90+/-1 dBrn
1 kHz	90 dBrn Reference
10 kHz	89+/-1 dBrn
15 kHz	87+/-1 dBrn
30 kHz	78+/-1 dBrn
60 kHz	0 dBrn Maximum

H. PROGRAM FILTER

2.4.43 Objective:

This test checks the noise-weighting effectiveness of the program filter measured by the dBrn level at varying frequencies.

2.4.44 Equipment:

No change from previous test.

2.4.45 Setup:

No change from previous test.

2.4.46 Initial Settings:

This test requires the following initial program setting:

ENTER [25] on the 1125 keypad to select the program filter function. The PROGR LED should light.

2.4.47 Test:

To test the program filter, follow this procedure:

(1) Change the AC calibrator frequency settings one at a time through the series listed in the first column of Table 2.2-H.

(2) For each frequency setting, check the 1125 left display to see if the dBrn level reading agrees with the specification level listed in the second column of the same table.

TABLE 2.4-H
PROGRAM FILTER TEST

FREQUENCY (Calibrator Setting)	dBrn EFFECT (1125 Left Display)
0.100 kHz	64+/-2 dBrn
1.000 kHz	90 dBrn Reference
7.000 kHz	96+/-2 dBrn
50 kHz	30 dBrn Maximum

I. 50 kBIT Filter

2.4.48 Objective:

This test checks the noise-weighting effectiveness of the 50 kBIT filter measured by the dBrn level at varying frequencies.

2.4.49 Equipment:

No change from previous test.

2.4.50 Setup:

No change from previous test.

2.4.51 Initial Settings:

This test requires the following initial program setting:

ENTER [26] on the 1125 keypad to select the 50 kBIT filter function. The 50 kB LED should light.

2.4.52 Test:

To set the 50 kBIT filter, follow this procedure:

(1) Change the AC calibrator frequency settings one at a time through the series listed in the first column of Table 2.4-I

(2) For each frequency setting, check the 1125 left display to see if the dBrn level reading agrees with the specification level listed in the second column of the same table.

TABLE 2.4-I
50 kBIT FILTER TEST

FREQUENCY (Calibrator Setting)	dBrn EFFECT (1125 Left Display)
0.100 kHz	89+/-1 dBrn
1.000 kHz	90 dBrn Reference
5.000 kHz	90+/-1 dBrn
10 kHz	90+/-1 dBrn
25 kHz	88+/-1 dBrn
35 kHz	85+/-2 dBrn
45 kHz	75+/-3 dBrn
50 kHz	66+/-4 dBrn
52.5 kHz	60+/-3 dBrn
55 kHz	56+/-6 dBrn Maximum

J. 1010 Hz NOTCH FILTER

2.4.53 Objective:

This test checks the noise-weighting effectiveness of the notch filter measured by the dBrn level at varying frequencies.

2.4.54 Equipment:

No change from previous test.

2.4.55 Setup:

No change from previous test.

2.4.56 Initial Settings:

This test requires the following initial program settings:

(1) ENTER [24] on the 1125 keypad to select the 15 kHz filter function. The 15 kHz LED should light.

(2) ENTER [27] on the 1125 keypad to select the notch filter function. The NOTCH LED should light.

2.4.57 Test:

To test the notch filter, follow this procedure:

(1) Change the AC calibrator frequency settings one at a time through the series listed in the first column of Table 2.4-J

(2) For each frequency setting, check the 1125 left display to see if the dBrn level reading agrees with the specification level listed in the second column of the same table.

2.4.58 Restore 1125:

After completing the six filter tests, restore the 1125 so that it bypasses all filters. To do this ENTER [20] and check to see that the LEVEL dBm LED lights.

TABLE 2.4-J
NOTCH FILTER TEST

FREQUENCY (Calibrator Setting)	dBrn EFFECT (1125 Left Display)
0.400 kHz	>89 dBrn
0.862 kHz	>87 dBrn
0.995 kHz	<40 dBrn
1.010 kHz	<30 dBrn
1.025 kHz	<40 dBrn
1.182 kHz	>87 dBrn
1.700 kHz	>89 dBrn
3.000 kHz	90+/-4 dBrn

K. VARIABLE FREQUENCY OSCILLATOR SET

2.4.59 Objective:

This test checks the oscillator function at variable frequencies.

2.4.60 Equipment:

This test requires the following equipment:

- Hewlett-Packard 5381A Frequency Counter or its equivalent
- Test cable with a BNC plug on one end and a dual-banana plug on the other.

2.4.61 Setup:

Make the following setup change from the previous test:

(1) Insert the test cable BNC plug into the INPUT jack of the frequency counter.

(2) Insert the dual-banana plug into the binder posts of the 1125 B pair jack, with the highside in the T (TIP) binder post.

2.4.62 Settings:

Enter the following program commands using the keypad:

(1) ENTER [13]. The TRAN (Transmit) LED should light.

(2) ENTER [30] to vary the frequencies used during the test. The FREQ SET LED should light.

2.4.63 Test:

To test the variable frequency oscillator set, do the following:

(1) Using the 1125 keypad, type in the frequencies listed in the left hand column of Table 2.4-K.

(2) Check to make sure the 1125 right display shows the correct frequency.

(3) For each frequency setting, check the frequency counter display to see if the readings on the two instruments agree with each other and with the specification level listed in the second column of the same table.

TABLE 2.4-K
VARIABLE FREQUENCY OSCILLATOR SET

FREQUENCY SET (1125 Transmission Set)	FREQUENCY MEASURE (Frequency Counter)
0.040 kHz	0.040 kHz
0.100 kHz	0.100 kHz
1.000 kHz	1.000 kHz
10.00 kHz	10.00 kHz
25.00 kHz	25.00 kHz
50.00 kHz	50.00 kHz
75.00 kHz	75.00 kHz
100.00 kHz	100.00 kHz
110.00 kHz	110.00 kHz

L. FIXED FREQUENCY OSCILLATOR SET

2.4.64 Objective:

This test checks the oscillator function at the fixed frequencies built into the Model 1125.

2.4.65 Equipment:

This test requires the following equipment:

- 1122B Transmission Test Set or an equivalent test instrument that measures frequencies.
- Test cable with a 310 plug at each end.

2.4.66 Setup:

Make the following setup change from the previous test:

(1) Disconnect the cable used in the previous test.

(2) Insert one 310 plug into the A pair jack of the 1122B test set.

(3) Insert the other 310 plug into the B pair jack of the 1125.

2.4.67 Settings:

This test requires these verifications or changes of instrument settings:

(1) Make sure the 1125 TRANSFER switch is set to REC A, TRAN B.

(2) Make sure the A pair jack of the 1122B is set to RECEIVE rather than to TRANSMIT.

2.4.68 Test:

To test the fixed frequency oscillator set, do the following:

(1) Using the 1125 keypad, type in the fixed frequency programs listed in the left hand column of Table 2.4-L.

(2) Check to make sure the 1125 right display shows the correct frequency.

(3) For each frequency setting, check the 1122B display to see if the readings on the two instruments agree with each other and with the specification level listed in the second column of the same table.

TABLE 2.4-L
FIXED FREQUENCY OSCILLATOR SET

FREQUENCY SET (1125 Transmission Set)	FREQUENCY MEASURE (Frequency Counter)
ENTER [33]	1125 404 Hz LED lights. Freq. Counter displays 404 Hz +/-0.1%
ENTER [34]	1125 1004 Hz LED lights. Freq. Counter displays 1004 Hz +/-0.1%
ENTER [35]	1125 2713 Hz LED lights. Freq. Counter displays 2713 Hz +/-0.1%
ENTER [36]	1125 2804 Hz LED lights. Freq. Counter displays 2804 Hz +/-0.1%

M. OSCILLATOR LEVEL SET

2.4.69 Objective:

This test checks the level set function of the 1125 oscillator.

2.4.70 Equipment:

No change from previous test.

2.4.71 Setup:

No change from previous test

2.4.72 Settings:

Enter the following program commands, using the 1125 keypad:

(1) ENTER [34]. The 1004 Hz LED should light.

(2) ENTER [31]. The LEVEL SET LED should light and flash.

2.4.73 Test:

To test the oscillator level set, do the following:

(1) Use the 1125 keypad to set varying levels by typing in the values listed in the first column of Table 2.4-M.

Note: Enter the plus (+) sign as indicated or negative values are automatically entered as the default. Values in the lower half of the first column of the table cannot be entered with a minus sign.

(2) Check to make sure the 1125 right display shows the correct frequency.

(3) For each LEVEL, check the 1122B left display to see if the readings on the two instruments agree with each other and with the dBm specification level listed in the second column of the same table.

TABLE 2.4-M
OSCILLATOR LEVEL SET

FREQUENCY LEVEL SET (1125 Transmission Set)	LEVEL SET MEASURE (+0.1 dBm) (1122B Transmissoin Test Set)
+ 10.0 dBm	+ 10.0 dBm
+ 9.0 dBm	+ 9.0 dBm
+ 8.0 dBm	+ 8.0 dBm
+ 7.0 dBm	+ 7.0 dBm
+ 6.0 dBm	+ 6.0 dBm
+ 5.0 dBm	+ 5.0 dBm
+ 4.0 dBm	+ 4.0 dBm
+ 3.0 dBm	+ 3.0 dBm
+ 2.0 dBm	+ 2.0 dBm
+ 1.0 dBm	+ 1.0 dBm
0.0 dBm	0.0 dBm
1.0 dBm	- 1.0 dBm
2.5 dBm	- 2.5 dBm
5.0 dBm	- 5.0 dBm
7.5 dBm	- 7.5 dBm
10.0 dBm	- 10.0 dBm
12.5 dBm	- 12.5 dBm
15.0 dBm	- 15.0 dBm
17.5 dBm	- 17.5 dBm
20.0 dBm	- 20.0 dBm
22.5 dBm	- 22.5 dBm
25.0 dBm	- 25.0 dBm
27.5 dBm	- 27.5 dBm
30.0 dBm	- 30.0 dBm
32.5 dBm	- 32.5 dBm
35.0 dBm	- 35.0 dBm
37.5 dBm	- 37.5 dBm
40.0 dBm	- 40.0 dBm

N. LOOPBACK IMPEDANCE

2.4.74 Objective:

This test checks the impedance function of the Model 1125.

2.4.75 Equipment:

This test requires no test equipment other than the 1125 Transmission Test Set and the test cable.

2.4.76 Setup:

Make the following setup change from the previous test:

(1) Remove the test cable connecting the Model 1125 and the Model 1122B.

(2) Insert the two 310 connectors of a loopback test cable into A pair and the B pair jacks of the 1125.

2.4.77 Settings:

Make the following changes, using the Model 1125 keypad:

(1) Reset the 1125 transmitter level to 0.0 dBm and 1.004 kHz.

(2) ENTER [14]. The REC LED should light. Make sure the 1125 displays show 0.0 dBm at 1.004 kHz.

2.4.78 Test:

To test the impedance functions, do the following:

(1) Change the TRANSMIT and RECEIVE dials to the same impedances, one setting at a time, according to the values listed in the first column of Table 2.4-N

(2) With each new setting, check to see that the impedance specification listed in the second column of the table is displayed in the 1125 left display as the test result.

TABLE 2.4-N

LOOPBACK IMPEDANCE TEST

IMPEDANCE SETTING (1125 Impedance Dials) Ohms	IMPEDANCE DISPLAYED (1125 Left Display)
135	0.0 dBm +/-.2
150	0.0 dBm +/-.2
600	0.0 dBm +/-.1
900	0.0 dBm +/-.2
1200	0.0 dBm +/-.2

O. IMPULSE-NOISE COUNT

2.4.79 Objective:

This test checks the accuracy of the 1125 fixed clock timing while counting noise-level hits.

2.4.80 Equipment:

This test requires no other test equipment than the Model 1125 Transmission Test Set.

2.4.81 Setup:

No change from previous test.

2.4.82 Settings:

Enter the following program command, using the 1125 keypad:

(1) Restore the 1125 TRANSMIT and RECEIVE dial settings to 600 ohms.

(2) ENTER [11] to select the impulse-noise function. The IMP N LED should light along with these other LEDS:

[22] CMSG
[27] NOTCH
[40] TOTAL COUNTS TH
[45] DISPLAY REF CTS
[51] 15 MIN

2.4.83 Test:

To test the impulse-noise clock count, follow the procedure in Chart 2.4-B.

CHART 2.4-B
IMPULSE NOISE CLOCK COUNT TEST

STEP	ACTION	RESULT
1	ENTER [50].	5 MIN LED LIGHTS
2	ENTER [42]. Type 34 on keypad to set the dBrn level.	REF SET LED lights. Sets impulse noise reference level to 34 dBrn.
3	Press START/STOP button on keypad. At the same time, start an independent timing with a reliable watch or clock.	COUNT LED lights. 1125 is now counting. The 1125 time and the watch or clock time should b about the same (5 mins).
4	Check the COUNT LED. Check the watch or clock.	COUNT LED goes off. The watch or clock time should also show 5 minutes.

P. WORST 15-MINUTE

2.4.84 Objective:

This test checks the ability of the Model 1125 to count and record the worst 15-minute impulse noise measurement period, along with the real-time occurrence.

2.4.85 Equipment:

This test requires the following equipment:

- Fluke 5200A Programmable AC Calibrator or equivalent
- Test cable with dual-banana plug at one end and 310 plug at the other.

2.4.86 Setup:

Make the following setup changes from the previous test.

(1) Remove the loopback cable from the Model 1125.

(2) Insert the dual-banana plug of the replacement cable into the OUTPUT jacks of the calibrator, with the ground plug in the LO jack.

2.4.87 Settings:

This test requires that the calibrator be set to 0.774596 volts RMS at 1.000 kHz.

2.4.88 Test:

To test the impulse-noise clock count, carry out the steps listed in Chart 2.4-C.

CHART 2.4-C
IMPULSE NOISE STATUS TEST

STEP	ACTION	RESULT
1	ENTER [11].	IMP N LED lights.
2	ENTER [24]. to change to the 15 kHz filter.	15 kHz LED lights.
	Enter [27] to make the notch filter inactive.	NOTCH LED goes out.
3	ENTER [52] to change the counting time.	60 MIN LED lights.
4	ENTER [42] to change the reference set.	REF SET LED lights.
	Type [94] on the keypad.	Sets reference level to 94 dBm.
5	Press START/STOP button.	COUNT LED lights. 1125 does NOT count.
6	Type [86] on the keypad. Note the time on a watch or clock.	Sets reference level to 86 dBm,1125 starts counting
7	When the 1125 right display reads between 100 and 200 counts, then type [94] to stop the counting.	1125 stopped from counting out of range.
8	Check the time. When more than 15 minutes has passed, then press START/STOP.	1125 stops counting.
	ENTER [41] to recall the worst 15 minutes of hits.	WORST 15 MIN LED lights. 1125 left display shows start time of worst 15. Right display shows number of counts during worst 15.

Q. DIAL-UP

2.4.89 Objective:

This test checks the ability of the Model 1125 to hold direct current dial-up lines.

2.4.90 Equipment:

This test requires the following equipment:

- Butt-in telephone handset
- Standard telephone patch cord with single 310 plug and RJ11 modular phone plug
- Standard dial or push button telephone handset connected to the line

2.4.91 Setup:

Make the following setup change from the previous test:

(1) Turn off the 1125 power switch.

(2) Remove the test cable used in the previous test.

(3) Insert the 310 plug of the new test cable in the 1125 A pair jack.

(4) Insert the RJ11 plug of the cable in the standard phone set being used.

(5) Clip the highside cable lead (red) of the butt-in telephone handset to the T (TIP) binding post of the A pair jack. Clip the ground cable lead (black) to the R (RING) binding post of the A pair jack.

(6) Turn on the 1125 power switch.

2.4.92 Settings:

Enter the following dial setting and program entry, using the 1125 keypad:

(1) Set the 1125 RECEIVE switch to DIAL. This disconnects the internal measuring circuitry.

(2) ENTER [14]. The REC LED should light.

2.4.93 Test:

To test the dial-up function of the 1125, follow the procedure in Chart 2.4-D.

2.4.94 End of Testing:

This completes the full series of Model 1125 performance tests. If any one or more of the test results reveal performance problems, make sure to note the results. See Par. 2.1.2c for instructions.

CHART 2.4-D
DIAL-UP TEST

STEP	ACTION	RESULT
1	ENTER [14].	REC LED lights.
2	Switch the butt-in handset from monitor to talk.	Listen for a dial tone from the handset as the handset seizes the current.
3	On the handset, dial the special dial-test number for the local area; it typically ends in 0020.	The standard telephone should ring.
4	Set the RECEIVE dial to 600 ohms.	1125 left display should read approximately -6 dBm.
5	Dial the RECEIVE dial to DIAL.	Releases the circuit.
6	Change the patch cord so that the two leads are clipped to the T and R binding posts of the B pair jack.	Connects butt-in handset to other 1125 jack.
7	Repeat Steps 2 through 4, above.	Tests dial-up after switching to the B pair jack

2.5 DISPLAY BOARD

2.5.1 Scope:

This section explains the functions of the display circuit board, summarizes its operation, and describes its circuits. It also briefly discusses the front panel. For reference purposes, it includes block diagrams, a board assembly drawing, and a circuit board schematic.

2.5.2 Location and Description:

The display circuit board is fastened to the rear face of the front display panel, with spacers in between to accommodate display board components. It holds the circuitry for the function described below and also holds most of the connectors and other hardware for the panel controls and displays used by the transmission test operator: keypads, dials, switches, jacks, speaker and LED lamps.

2.5.3 Disassembly and Reassembly:

See Section 2.2 for instructions disassembling the Model 1125 to access the display board and front panel.

CAUTION: Do not try to remove the display board from the front panel assembly, because of the intricate connections between them. The display board does not require calibration. Repair of the display board or panel should be done by Northeast Electronics Customer Service. For repair, the two should be shipped to Northeast Electronics as a single unit.

A. FUNCTIONS AND CIRCUITRY

2.5.4 Functions:

The display board is used chiefly as an overall system controller for the Model 1125. It has four functions:

- providing interfacing between boards- as mother board
- displaying received measurements and transmitter status, using seven segment displays
- responding to user key presses designating a mode of operation and related conditions within that mode
- turning on LEDs to indicate a designated mode of operation and related conditions

2.5.5 Operations:

When a user presses a key, an interrupt signal is sent to the microprocessor. Then, after a valid command is completed (programming numbers are two digits), the microprocessor sets proper LEDs, displays, and digits through its keyboard display interface port and display driver circuitry. See Figure 2.5-1.

2.5.6 Circuits:

There are eight common-anode, seven-segment displays (DS46-DS53) that share their eight input data lines A0X through A3X and B0X through B3X. (B3X is used for the decimal point.) these lines are usually logic high (TTL), and scanning lines A0 through A13 are usually logic low (TTL). Lines A1 through A7 are used to control common anode inputs to seven-segment displays. Data lines and scanning lines are both microprocessor controlled (Figure 2.5-2).

For example, to write the number 8 without a decimal point in DS50, the microprocessor should set logic high on A4 only and should set data lines as shown in Figure 2.5-3.

2.5.7 Normal lines A0X through A3X, B0X through B3X, and scanning lines A8 through A13 are used to control the LED's. When the Model 1125 is switched on, for example, and after the self-test routine ends, the microprocessor automatically selects TRANSMITTER and transmits 0.0 dBm at 1.004 kHz in the level or filter bypass condition. Consequently, the LED's light up for TMS, dBm 1004 Hz, kHz, and LEVEL dBm, and the control lines reflect this condition.

2.5.8 When A0X and A3X are both logic low, A8 is logic high. When A0X is logic low, A9 is logic high. When B0X is logic low, A10 is logic high. When A1X is logic low, A13 is logic high.

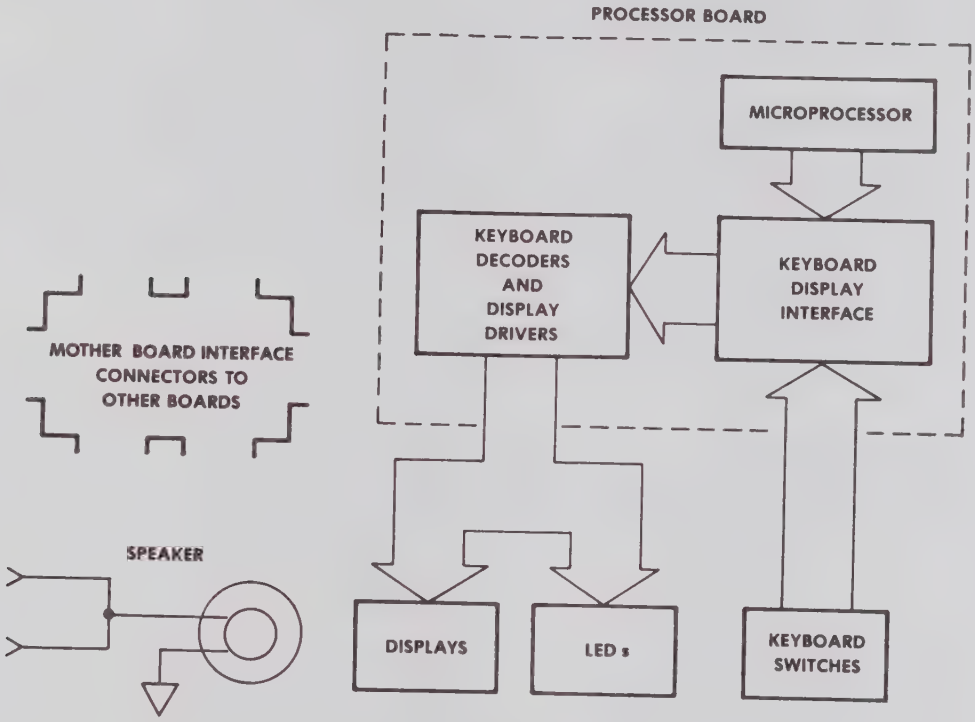


Figure 2.5-1 Block Diagram of Display Board Functions

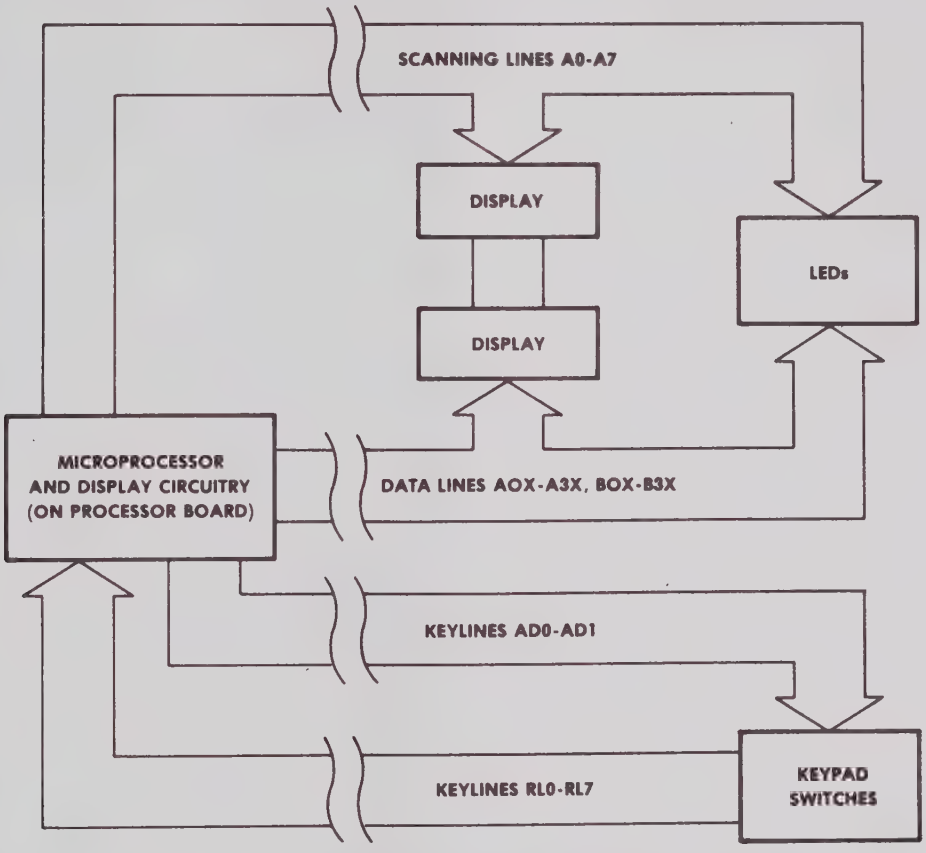


Figure 2.5-2 Block Diagram of Display Circuits

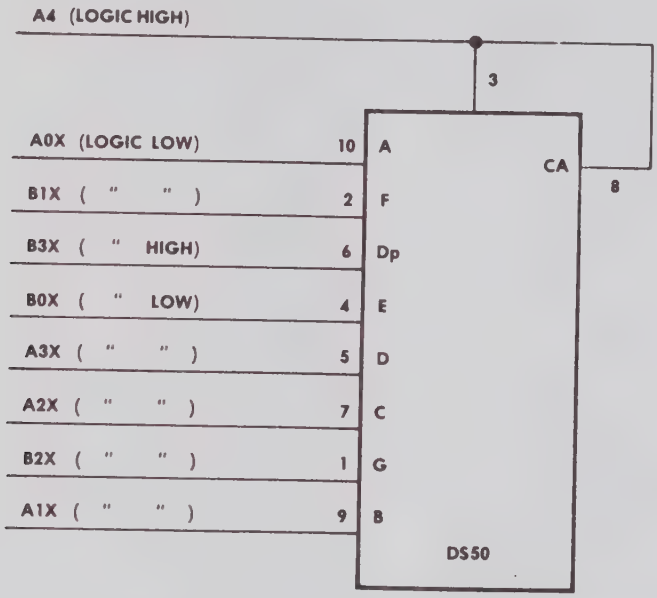


Figure 2.5-3 Data Line Settings to Write the Number 8

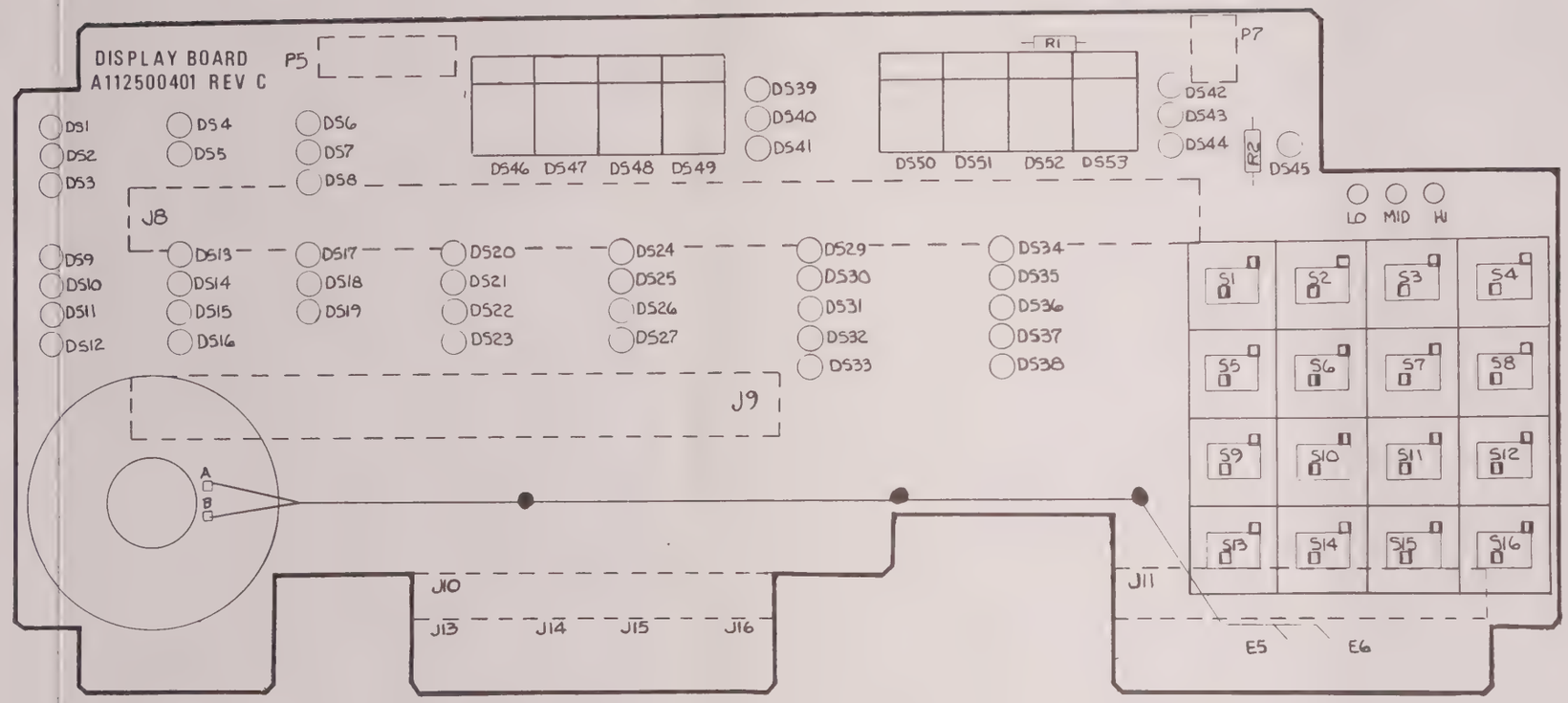
B. DRAWINGS AND PARTS LIST

2.5.9 Board Layout:

For the physical location of display board components, refer to the Component Location Drawing (Figure 2.5-4).

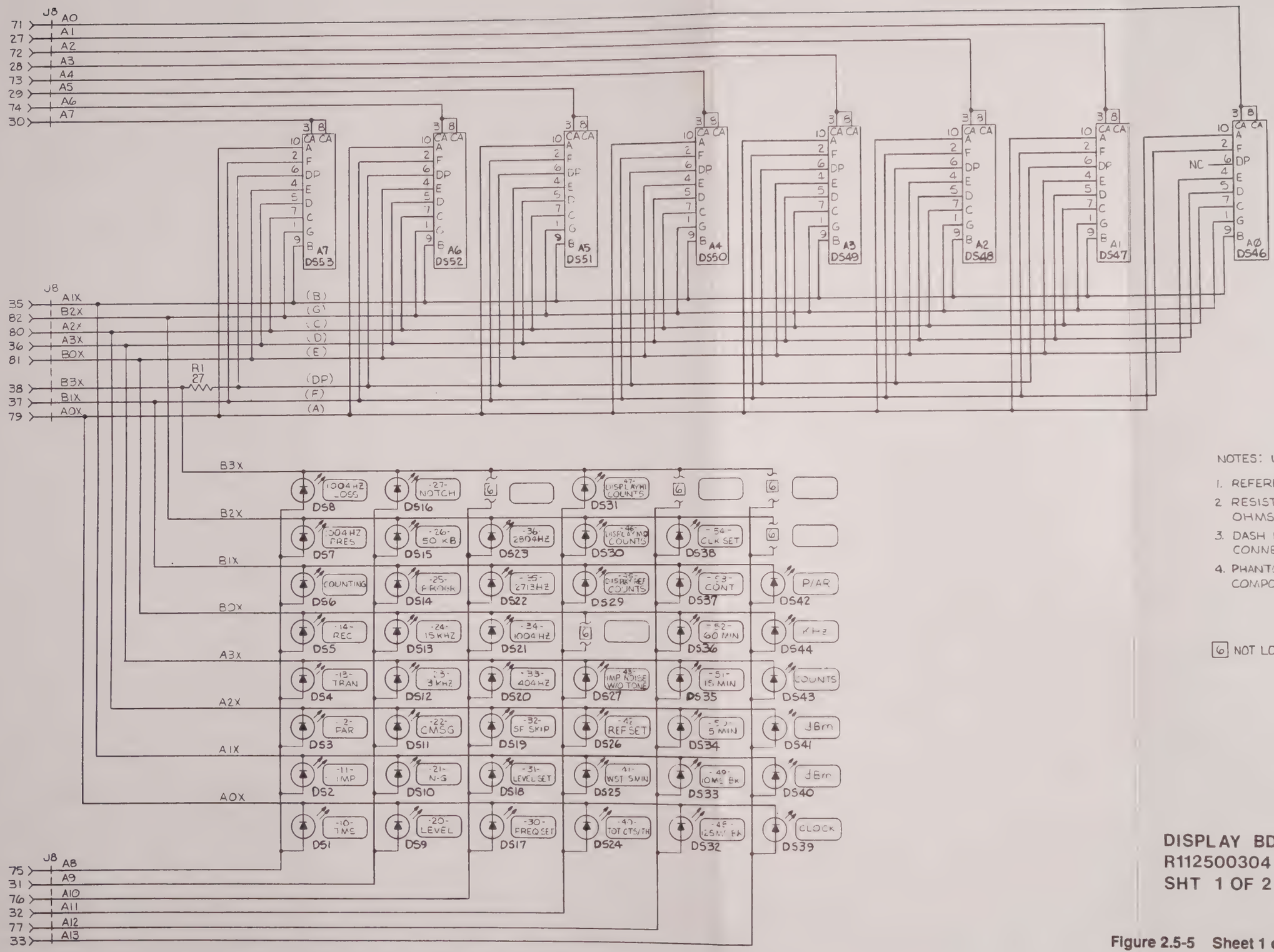
2.5.10 Schematic:

For circuit details, refer to the schematic for the display board (Figure 2.5-5).



WIRE LIST							
NO	COLOR	LENGTH	AWG	FROM	TO	ITEM	
1	WHT/BLU	10"	22	SPKR A	E5	7	6
2	WHT/GRN	10"	22	SPKR B	E6	8	6

Figure 2.5-4 Component Location Drawing Display Board



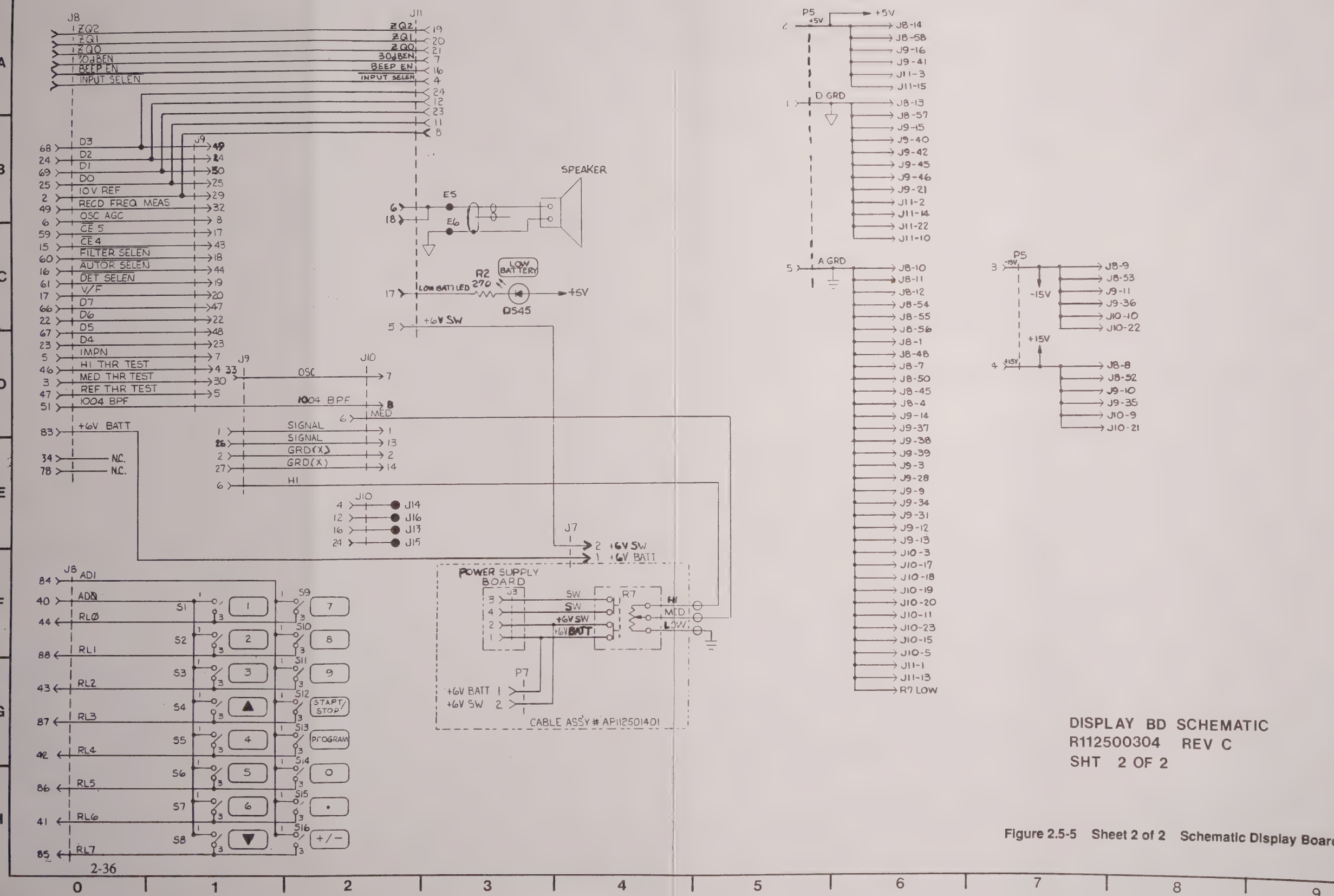
NOTES: UNLESS OTHERWISE SPECIFIED

1. REFERENCE PARTS LIST A 112500401.
2. RESISTANCE VALUES ARE EXPRESSED IN OHMS, 1/4 W, 5%.
3. DASH LINE (---) DENOTES MECHANICAL CONNECTION OR INTERLOCK
4. PHANTOM LINE (———) DENOTES A COMPONENT MOUNTED OFF THE RC. BOARD.

[6] NOT LOADED.

DISPLAY BD SCHEMATIC
R112500304 REV C
SHT 1 OF 2

Figure 2.5-5 Sheet 1 of 2 Schematic Display Board



DISPLAY BD SCHEMATIC
R112500304 REV C
SHT 2 OF 2

Figure 2.5-5 Sheet 2 of 2 Schematic Display Board

2.6 PROCESSOR BOARD

2.6.1 Scope:

This section explains the functions of the processor circuit board, summarizes its operation, and describes its circuits, For reference purposes, it includes block diagram, a component layout drawing, and a schematic.

A. FUNCTIONS AND CIRCUITRY

2.6.2 Functions:

The processor board is used chiefly for:

- Controlling the overall 1125 system by means of a microprocessor
- Providing memory storage for program instructions and test processing data
- Processing display and keypad data
- Decoding functions for the three measuring circuit boards
- Generating a transmission signal of a designated frequency, level, and waveform
- Establishing transmission clock generation and multiplexing
- Referencing voltage, sinewave, and P/AR levels
- Converting analog waveform to digital waveform
- Setting impulse-noise thresholds and counting impulse-noise spikes or hits
- Detecting a 1004 Hz tone when present
- Measuring the level and frequency of an incoming signal
- Providing real time clock operation and system timing

See Figure 2.6-1 for a block diagram of these functions.

2.6.3 Circuits:

The various processor board circuits operate in various ways, depending on which of the above functions require execution, See Figure 2.6-2. (Alphanumeric codes, such as U52, identify certain components in the Component Location and Schematic drawings, Figures 2.6-15 and 2.6-16).

2.6.4 System Processing and Memory:

Data processing and storage for the Model 1125 system is achieved by a microprocessor (U49) and two Programmable-Read-Only-Memory (PROM) chips (U38, U39) residing on the processor board (Figure 2.6-3). The 8-bit microprocessor has internal Random Access Memory (RAM) and port select circuitry. Each PROM holds 8K bytes of program instructions. The processor can address only 4K bytes of PROM, and therefore uses its ports 11 and 12 for memory bank switching, to gain a total program memory of 16K (U38 and U39). Two address latches (U27 and U47) hold address information during data transfer.

2.6.5 Waveform conversion:

On the processor board, a zero crossing detector with hysteresis (U51) converts analog waveform (0 to +5 volts). This conversion is used for microprocessor interfacing so that frequency measurements can be made (Figure 2.6-3).

2.6.6 Incoming Signal Measurement:

A programmable interval timer (U41) is used to make level and frequency measurements of an incoming signal (Figure 2.6-3). First, incoming signal levels are changed to a proportional frequency using a voltage-to-wave shaping circuit which converts the signal to a TTL shape. The interval timer then counts the signal over a specific interval, and the resulting value is processed. Frequency measurements are directly processed by the timer after signal conditioning to TTL specifications.

2.6.7 Real Time Clock Operation and System Timing:

A programmable real-time clock (U40) connected to the microprocessor's data bus, is used for accurate system timing and real-time clock operation (Figure 2.6-3). It is always connected to the battery for continuous operation by means of a chain of dropping diodes and a transistor.

2.6.8 Display and Keypad Data Processing:

A keypad display interface chip (U58) is used to process the 1125's display and keypad data (Figure 2.6-4). It handles all display refreshes, updates, and modifica-

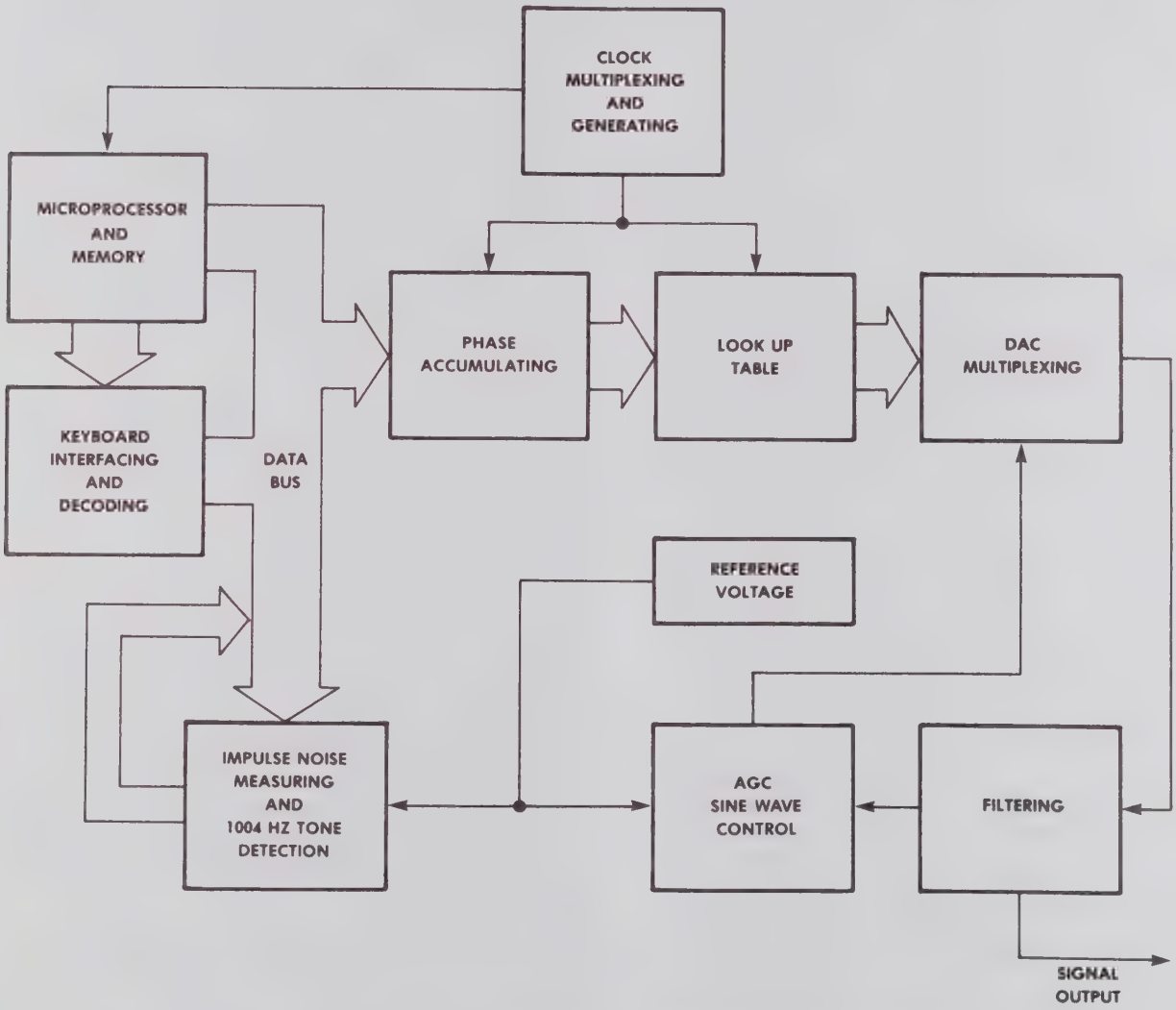


Figure 2.6-1 Block Diagram of Processor Board Functions

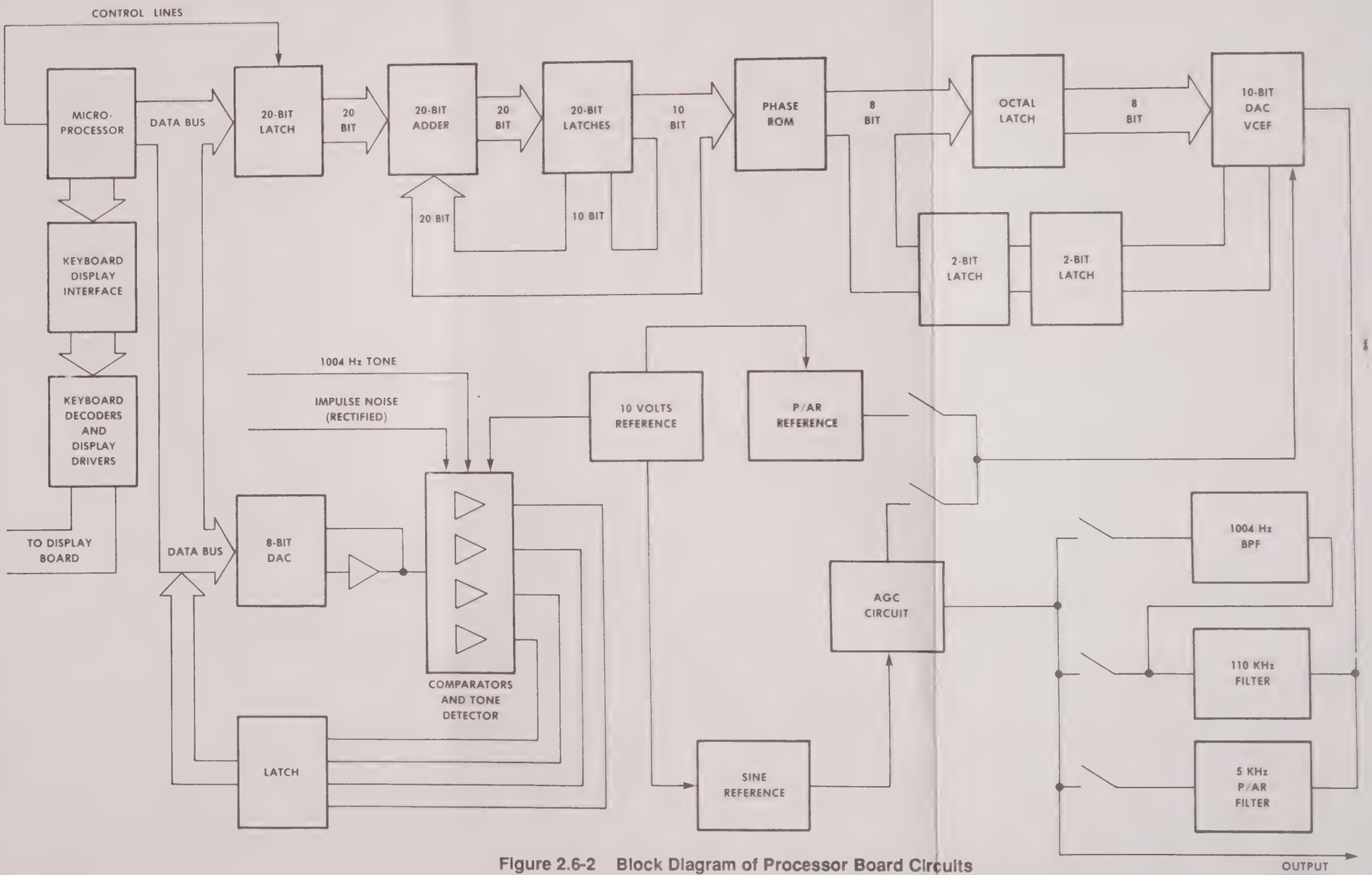


Figure 2.6-2 Block Diagram of Processor Board Circuits

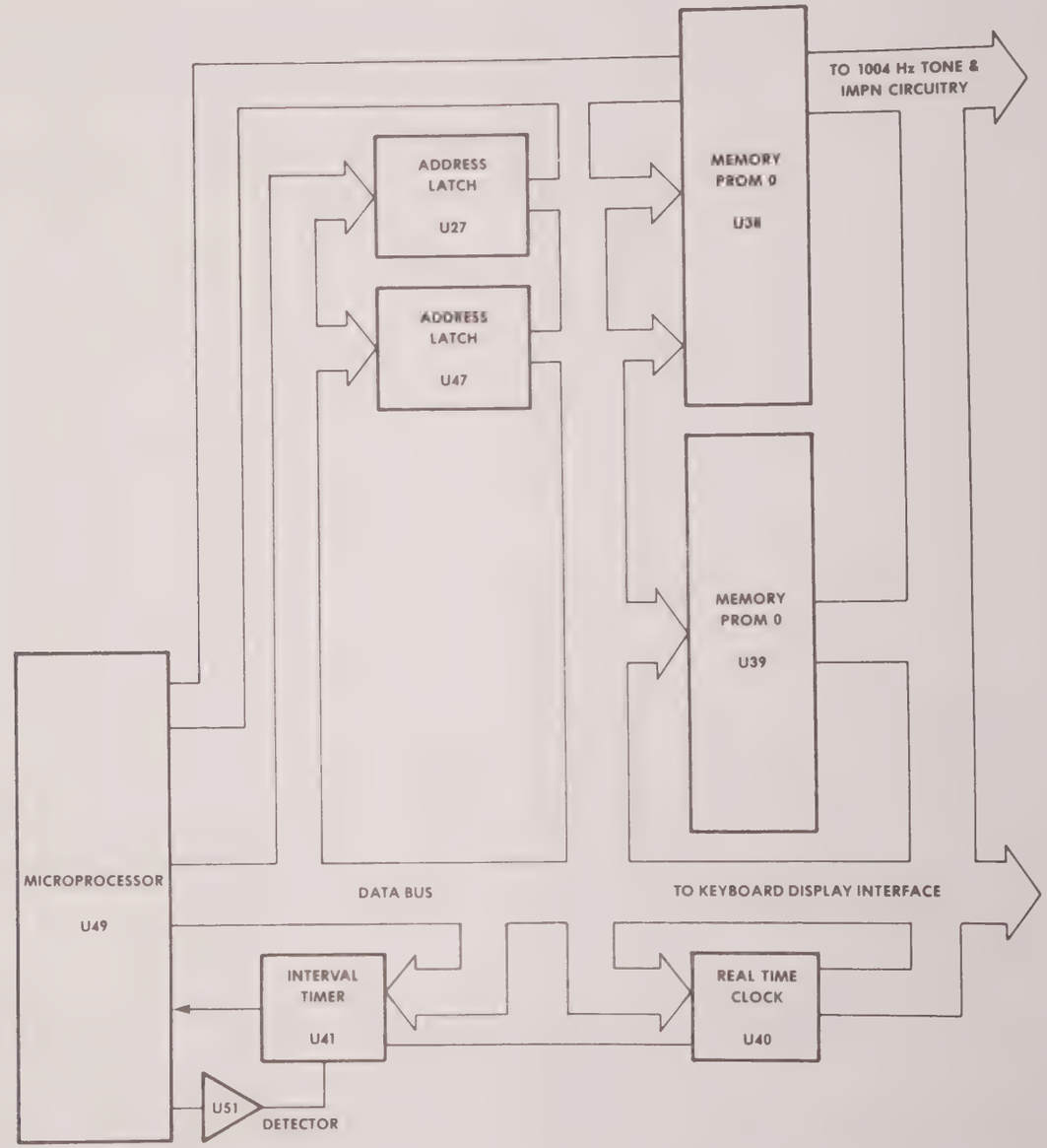


Figure 2.6-3 Block Diagram of Microprocessor and Memory Circuit

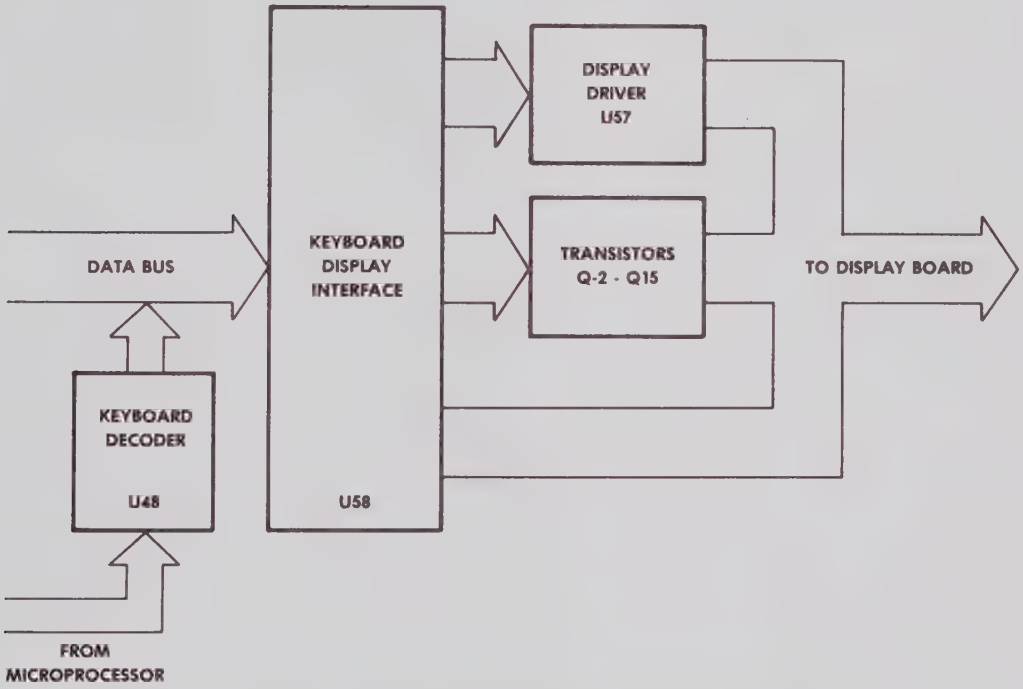


Figure 2.6-4 Block Diagram of Keyboard Display Interface Circuitry

tions, as well as scanning for user keypad strokes. Interface with the microprocessor is by means of eight data lines and six control lines. The high current drivers U37 and transistors Q2 through Q15 control the interface display signals and run the LED displays. Decoding of the keypad display is done by the decoder chip (U48) which also decodes the phase accumulation registers and the real-time clock.

2.6.9 Transmission Signal Generation:

One of the principal functions of the processor board is to generate a transmission signal of a designated frequency, level and waveform. This is caused initially by a phase address generator of the phase accumulation circuit and by waveform ROM and ROM latches. The following paragraphs describe and diagram these circuits, as well as, the clock circuitry.

2.6.10 Phase Accumulation Circuit:

In the phase accumulation circuit (Figure 2.6-5), the phase step latches hold the binary value (phase step size) of the frequency. This value changes only if the frequency is changed. The adders add the phase step size to the previous phase address to get a new phase address, which is locked into the phase address latch. This is done on the rising transition of the clock. The output of this phase address generator is a series of address memory locations in the phase ROM (EPROM U6).

2.6.11 The ROM and the ROM latches take the series of addresses and convert them into binary voltage values representing the output signal waveform. A digital-to-analog converter (DAC U14) circuit takes the binary voltage sequence from the voltage value latches and convert it to a sequence of step voltages approximating the output signal waveform. Since the DAC output is a current, a current-to-voltage converter is used.

2.6.12 Clock Generating and Multiplexing Circuit:

The phase accumulation circuit and the phase ROM and ROM latches are given the proper clock frequency by a transmit clock generator, which also provides a 2.6144 MHz clock (Y1) to the microprocessor (Figure 2.6-6). Sine waveform and P/AR waveform clocks are multiplexed with a latching control line set by the microprocessor through the data bus.

2.6.13 High Frequency Filters:

The output of the current-to-voltage converter is only an approximation of the desired signal output. This is because of unwanted high-frequency components that are introduced by the step nature of the waveform. These components must be filtered (Figure 2.6-7). The P/AR waveform is filtered by the 5kHz third-order low-pass filter (U52), and the sinewave by the 110 kHz second-order low-pass filter (U13), high-quality bandpass filter. A high-quality bandpass filter (U16) is used to increase the purity of the 1004 Hz signal.

2.6.14 Voltage, Sinewave, and P/AR Level Reference:

To keep the sinewave amplitude constant over frequency and time, an automatic gain control (AGC) circuit creates a DC signal which controls digital-to-analog converter amplitude, The AGC circuit consists of a full-wave rectifier, integrator, and reference voltage. The 10-volt reference has low temperature drift and high accuracy. This reference voltage is used for level and frequency measurement, noise measurement, transmitter sinewave and P/AR level adjustments, low battery detect, and impulse noise threshold set. (See Figure 2.6-8).

2.6.15 Impulse Noise Measurement:

On the V/F board, a Receive Impulse Noise measurement signal is first routed through a C-notch filter and then amplified (using autorange gain circuitry) according to the threshold setting (high, middle, and reference). On the processor board, three comparators (U3) compare the impulse noise of the signal with the three preset thresholds (Figure 2.6-9). These thresholds are set by the microprocessor through the digital to analog converter and associated circuitry. The output of the comparators is processed by the microprocessor and counting block, where the impulse noise hits are given the proper repetition rate and counted. The microprocessor keeps a running total of the number of counts from each comparator.

2.6.16 1004 Hz Tone Detection:

The microprocessor also monitors to see whether or not a 1004 Hz tone is present by checking the output status of the 1004 Hz tone detector (U3). If the tone level is greater than -40 dBm, a 1004 Hz tone is detected. (This detection functions only at the 600-ohm and 900-ohm termination impedances.)

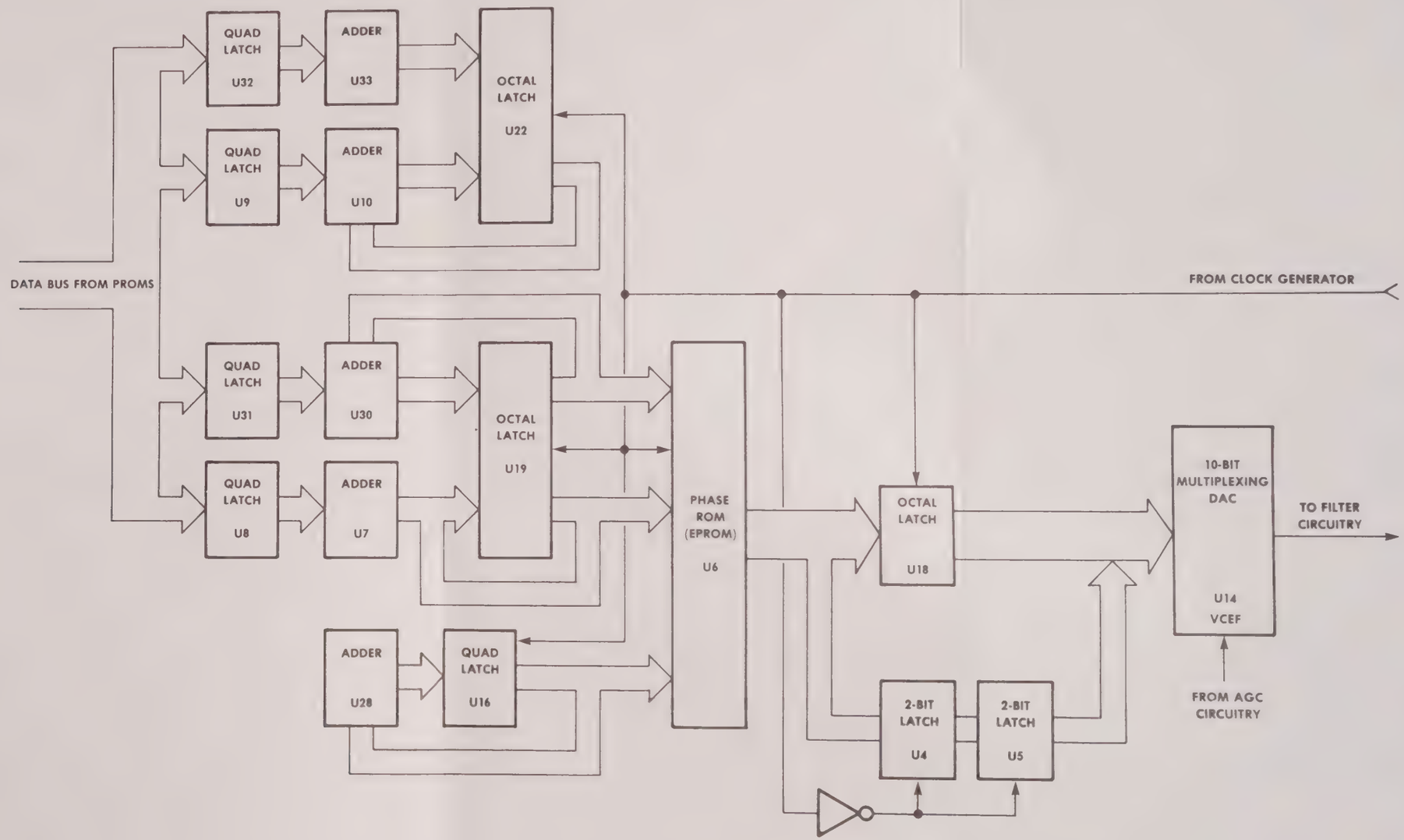


Figure 2.6-5 Block Diagram of Phase Accumulation Circuitry

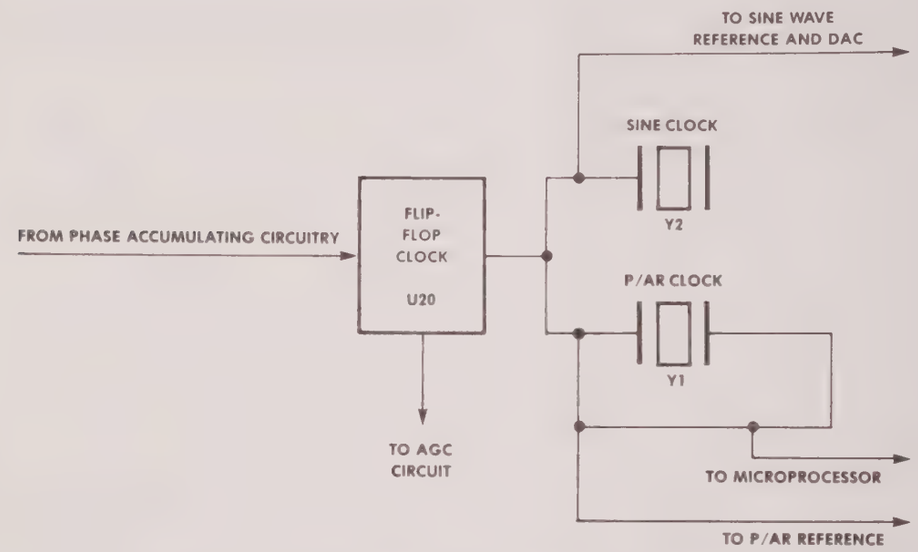


Figure 2.6-6 Block Diagram of Transmission Clock Circuitry

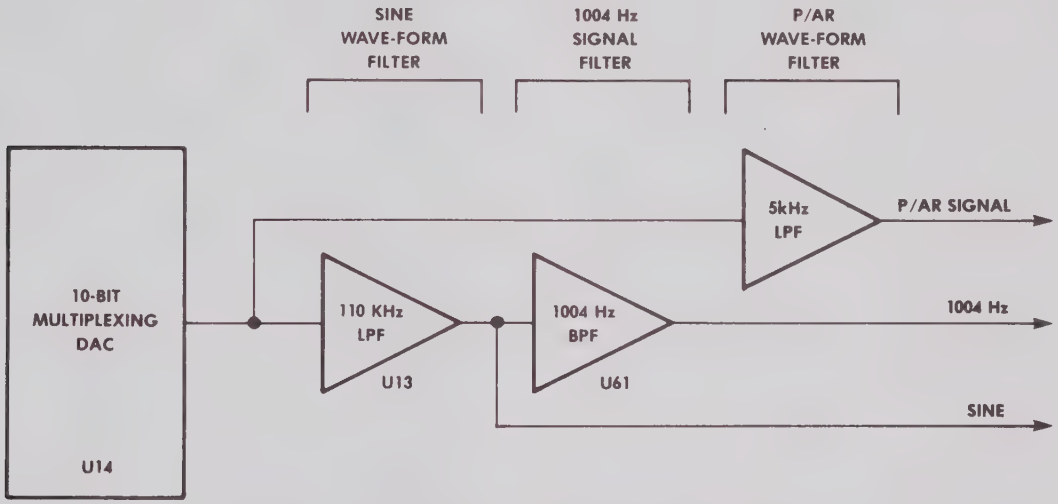


Figure 2.6-7 Block Diagram of Filter Circuitry

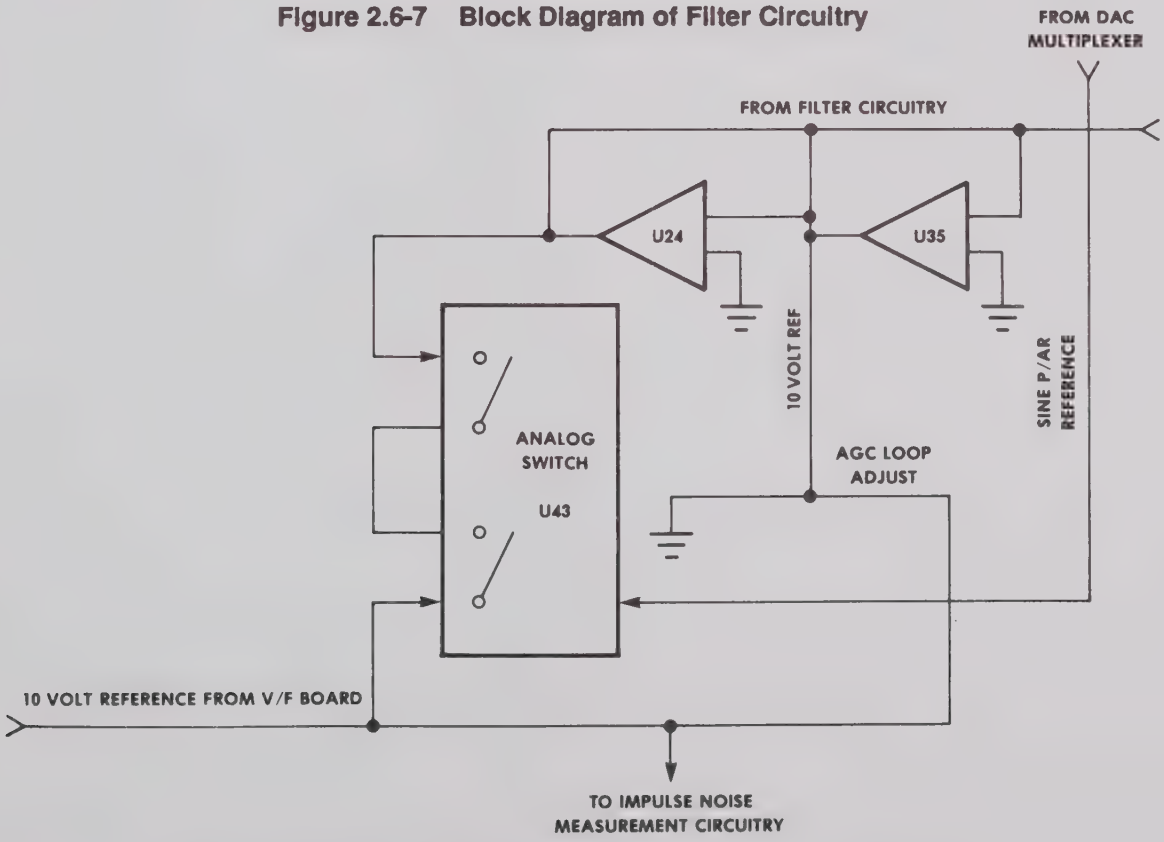


Figure 2.6-8 Block Diagram of AGC and Reference Circuitry

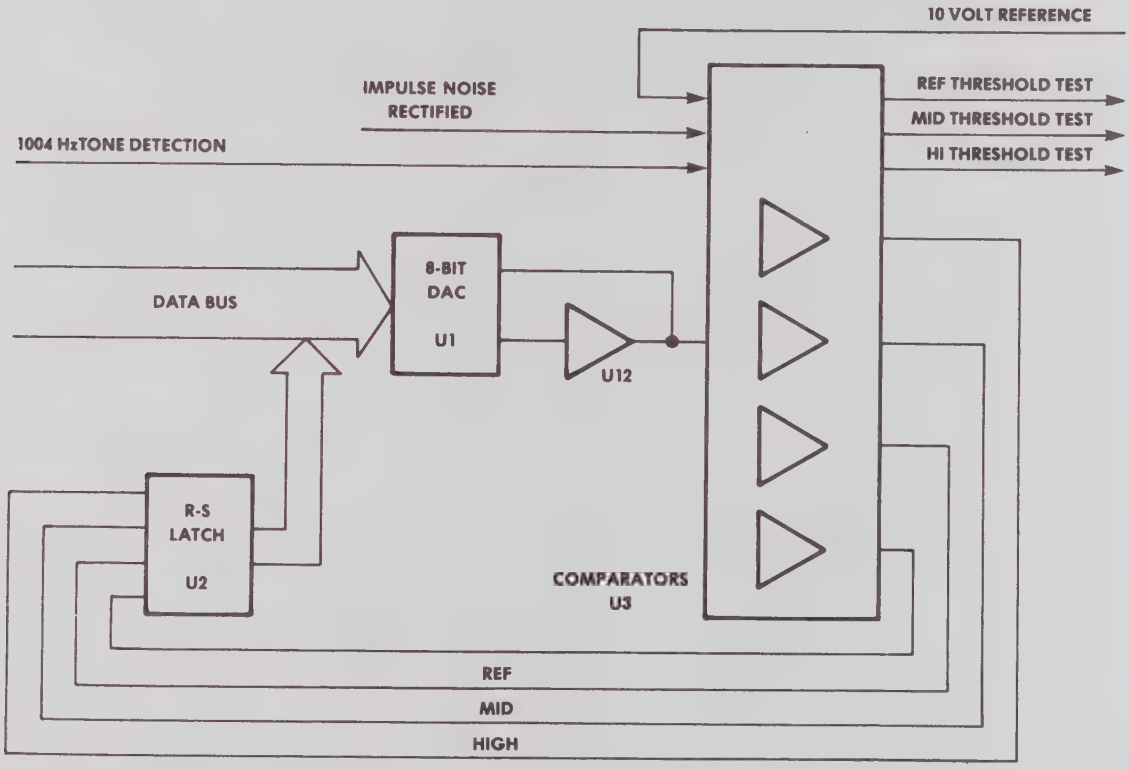


Figure 2.6-9 Block Diagram of Impulse Measurement Circuitry

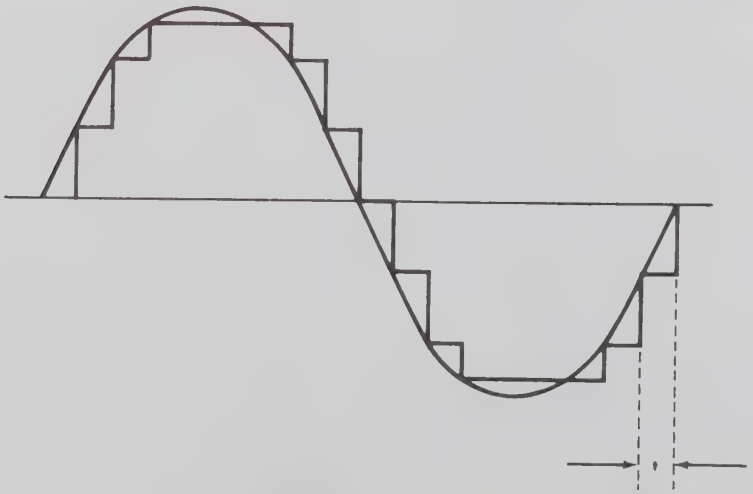


Figure 2.6-10 Diagram of a Sinewave Constructed From Samples

2.6.17 Impulse Noise, Sinewave, and P/AR Theory:

Both sine and P/AR waveforms are processed by the same transmitter circuitry, but sinewave is emphasized here to illustrate how the signal waveform is produced and transmitted, For impulse noise theory and P/AR theory, see Section 2.3.12.

2.6.18 The transmitter circuitry is controlled digitally through the date bus from the microprocessor, which determines the frequency level and type of output waveform.

Note: The transmitter circuitry also provides output through a transformer on the I/O board to the 310 jacks on the front display panel and to the receive circuitry. A transmitter loop is made that can be used for self-testing.

2.6.19 A sinewave can be constructed from a number of amplitude samples along the wave. This series of sample numbers is saved in ROM. Then it can be recalled by stepping through (scanning) the ROM. The recalled numbers are converted to a series of voltage levels resembling a stair-step approximation of the original signal. The holding time of each sample appears as high-frequency distortion. This can be eliminated by proper filtering. The holding time or interval, J=1/fs, is set by a sampling theorem (Nyquist's interval) where fs (sampling rate) is at least greater than twice the highest frequency signal. See Figure 2.6-10 for a sinewave diagram.

2.6.20 The sampling principle described in the above paragraph is used in the 1125. A series of binary numbers saved in ROM represent sinewave (or P/AR) waveform. The microprocessor and associated circuitry scans the ROM, converts the numbers to voltage levels, filters out the high-frequency distortion components, and amplifies the resulting waveform to provide the desired signal. The result is that the 1125's ROM contains two full waveforms in two locations. The desired sinewave is selected by switching a ROM address bit using the sinewave P/AR select signal.

B. DRAWINGS AND PARTS LIST

2.6.21 Board Layout:

For the physical location of processor board components, refer to the Component Location Drawin (Figure 2.6-14).

2.6.22 Schematic:

For circuit details, refer to the schematic for the processor board (Figure 2.6-15).

2.6.23 PROCESSOR BOARD CALIBRATION

2.6.24 SCOPE:

This topic gives instructions for setting up and conducting calibration procedures for the Model 1125 processor circuit board:

- the 4.11194394 mHz CLOCK
- the 6.144 mHz CLOCK
- the peak-to-average or P/AR LEVEL
- the sine level

Table 2.6-A lists the test points to be used and the associated calibration adjustments. Figure 2.6-11 shows their locations on the processor board.

TABLE 2.6-A
PROCESSOR BOARD TEST POINTS AND ADJUSTMENTS

TEST POINT (TP)	FUNCTION	ADJUSTMENT (R) OR (C)	FUNCTION
TP 33	Digital ground.	C 20	Adjusts 4.194304 mHz clock (sine-wave generator).
TP 7	4.194304 mHz clock.		
TP 9	6.144 mHz clock.	C 21	Adjusts 6.144 mHz clock (P/AR generator and microprocessor).
TP 8	Sampling frequency		
TP 6	Analog ground.	R 42	Adjusts sine level.
TP 14	OSC AGC.	R 44	Adjusts P/AR level.

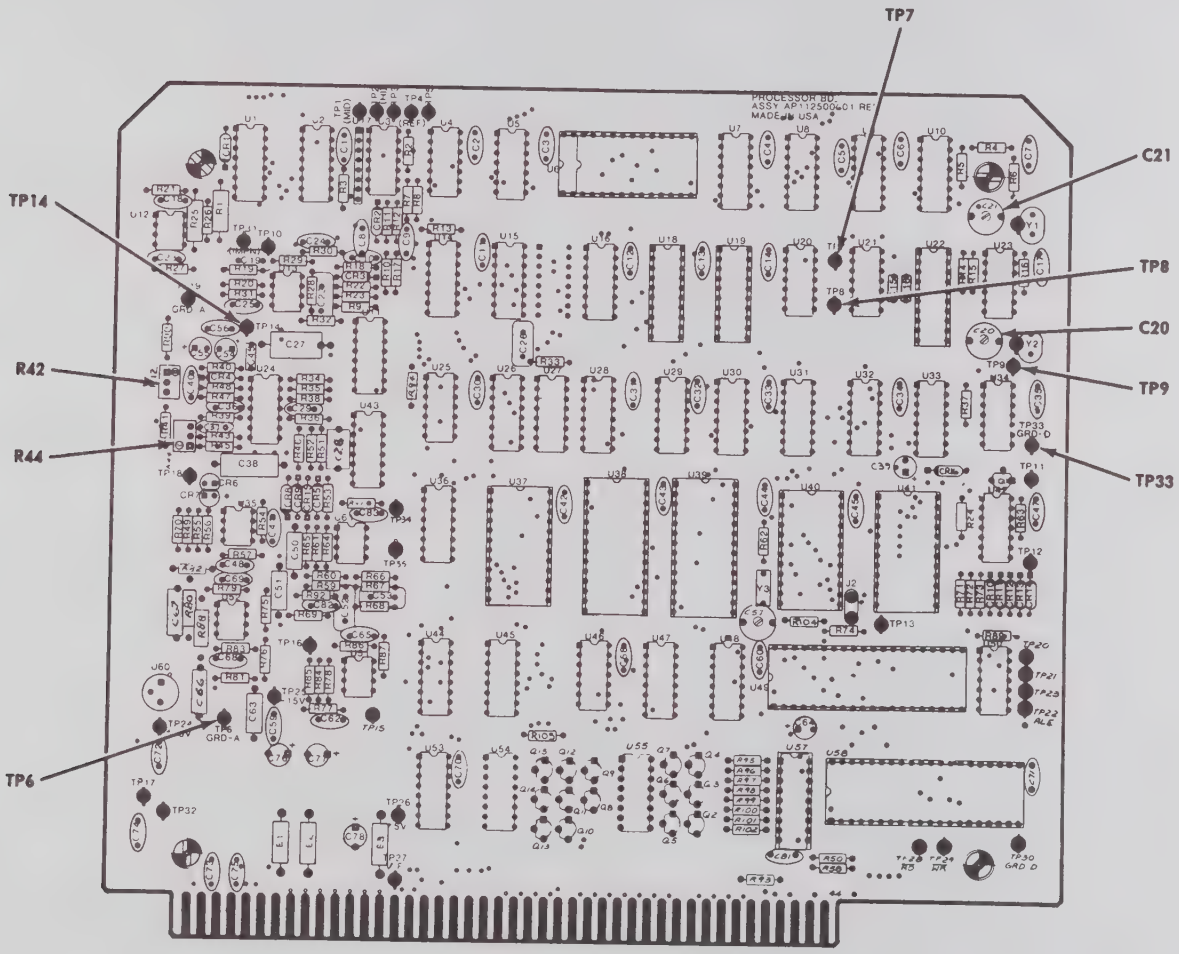


Figure 2.6-11 Processor Board Calibration Locations

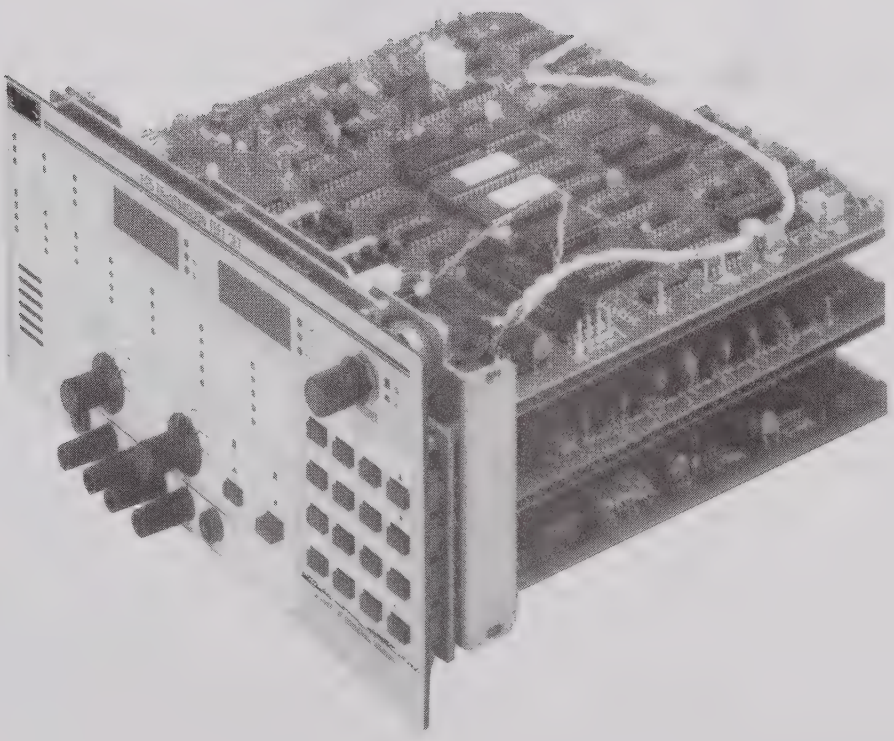


Figure 2.6-12 Reassembly of Circuit Boards and Front Panel

Figure 2.6-13 Setup for Processor Board Calibration

A. PROCESSOR BOARD CALIBRATION (C20, C21)

2.6.25 Calibration Equipment:

This calibration requires the following equipment:

- Hewlett-Packard 5381A Frequency Counter or its equivalent
- Test cable with a dual-banana plug at one end and two alligator clip leads at the other
- Test cable with a BNC plug at one end and two alligator clip leads at the other end.

2.6.26 Setup:

Before calibrating clock frequencies, make these setup changes (Refer to Fig. 2.6-11):

(1) Select the cable with the BNC plug at one end and two alligator clip leads at the other. Insert the BNC plug into the INPUT jack of the frequency counter.

(2) Clip the frequency counter digital ground cable lead (black) to test point TP33 on the processor board.

(3) Clip the frequency counter high-side cable lead (red) to TP7 on the processor board.

(4) The calibrator and voltmeter are not used in making this adjustment.

2.6.27 Calibrate Clocks:

To calibrate the 1125 processor board clock frequencies, follow the instructions given in Chart 2.6-A.

CHART 2.6-A
CALIBRATE CLOCKS

STEP	ACTION	FUNCTION	INDICATORS
1	Adjust C20 on processor board for frequency shown in right column.	Calibrates 4.194304 MHz clock.	4.194304 mHz reading on the frequency counter, or as close as possible.
2	Move frequency counter high-side cable to TP 9 on the processor board.	Connects frequency counter output to clock.	
3	Adjust C 21 on processor board for frequency shown in right column.	Calibrates 6.144 mHz clock.	6.144 mHz reading on the frequency counter, or as close as possible
4	Move frequency counter high-side cable to TP 8 on the processor board.	Connects frequency counter output to clock.	
5	ENTER [12] on the 1125 keypad.	Selects peak-to-average ratio (P/AR) measurement.	P/AR LED lights. 128 kHz reading on frequency counter.

B. SINE LEVEL AND P/AR CALIBRATIONS (R42, R44)

2.6.28 Calibration Equipment:

This calibration requires the following equipment:

- Hewlett-Packard 3456A Digital Voltmeter or its equivalent
- Test cable with a dual-banana plug at one end and two alligator clip leads at the other end.

2.6.29 Setup:

Before calibrating the SINE and P/AR levels, follow these setup steps.

(1) The frequency counter is not needed; remove the cable connecting it to the circuit board.

(2) Clip the digital voltmeter ground cable lead (black) to TP6 on the processor board.

(3) Clip the voltmeter high-side cable lead (red) to TP14 on the processor board.

2.6.30 Initial Settings:

This calibration requires returning the voltmeter to ACV.

2.6.31 Calibrate Sine and P/AR Level:

To calibrate the 1125 processor board sine and P/AR levels, follow the instructions given in Chart 2.6-B.

2.6.32 Restore Equipment Setup:

The processor board is now calibrated. This completes the calibration of the 1125 Transmission Test Set. Before running performance test on the 1125, restore the equipment to its precalibration status, following these steps:

(1) Disconnect the 1125 power cable from the external source and turn off the power switch.

(2) Unclip the cable leads connecting the voltmeter to the 1125.

(3) Remove the rear bezel from the frame by removing the four screws holding it.

(4) Slide the side and top panels into the frame.

(5) Refasten the rear bezel to the frame.

(6) In preparation for performance testing the 1125, reconnect the power cable to the external source.

2.6.33 Next Step:

To test the performance of the Model 1125 after calibration, turn to Section 2.4.

2.6.34 Recording Calibration Date:

After the 1125 is calibrated and tested, write the calibration date on a label or sticker and fasten it on the outside of the rear panel. The instrument should be calibrated every twelve months.

CHART 2.6-B
CALIBRATE SINE AND P/AR LEVELS

STEP	ACTION	FUNCTION	INDICATORS
1	ENTER [10] on 1125 keypad.	Sets transmitter DAC output.	TMS LED lights up.
2	Adjust R 2 on processor board for volts shown here.	Calibrates the sine level.	3.47+/-.01 volts ac reading on the voltmeter display.
3	ENTER [12] on 1125 keypad.	Activates P/AR measuring mode.	P/AR LED lights.
4	Adjust R 44 on processor board for volts shown here	Calibrates the P/AR level.	0.6519+/-.001 volts ac reading on the voltmeter.
5	Insert loopback test cable in 1125 A pair and B pair jacks.	Sets up to check P/AR.	
6	ENTER [14] on 1125 keypad.	Activates RECEIVE mode.	REC LED lights. 1125 displays 0.0+/-.3dBm at 100+/-1 PAR.

2.6.35 Board Layout:

For the physical location of processor board components, refer to the Component Location Drawing Figure 2.6.14.

2.6.36 Schematic:

For circuit details, refer to the schematic for the processor board, Figure 2.6.15.

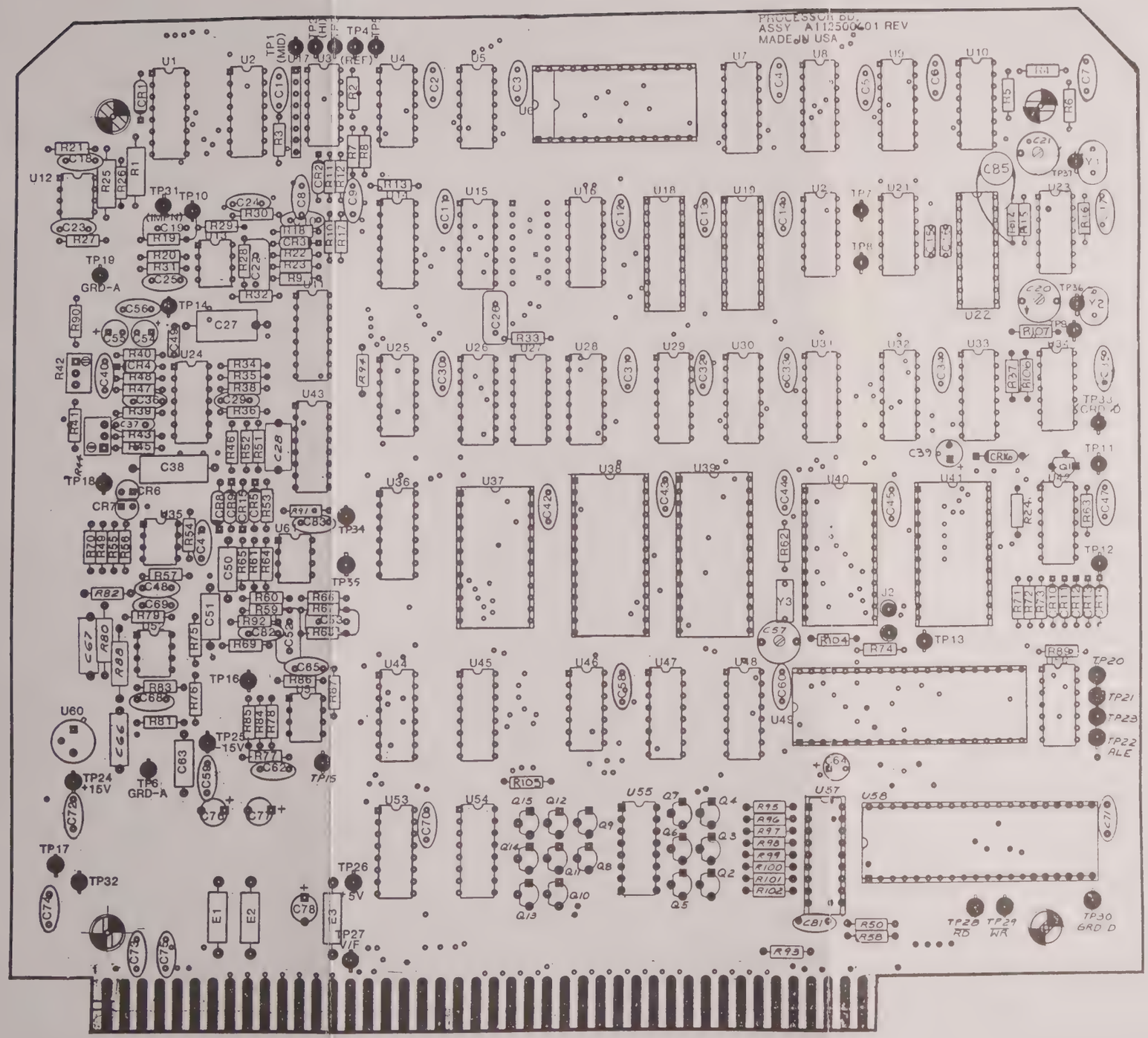


Figure 2.6-14 Component Location Drawing Processor Board

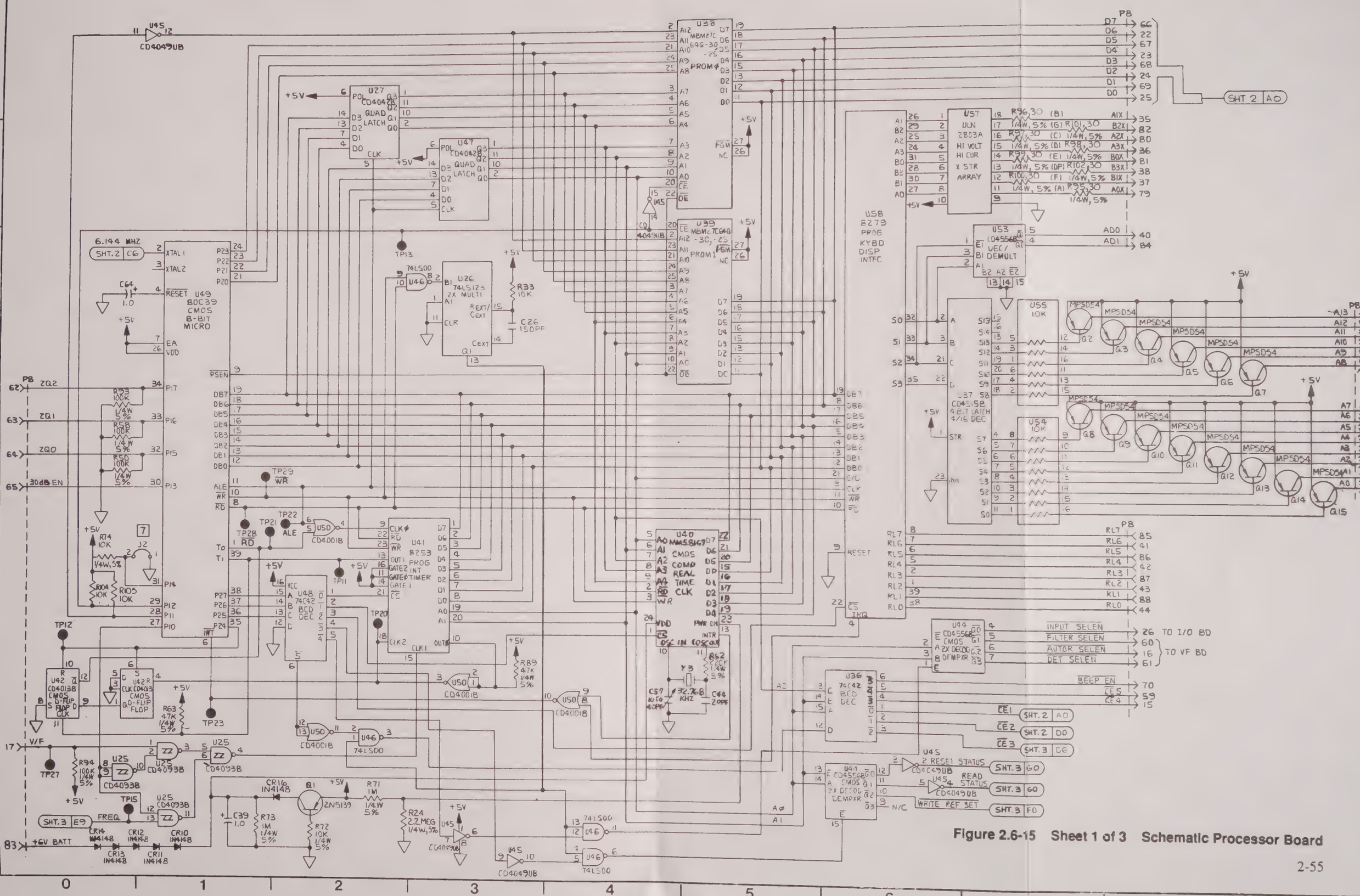
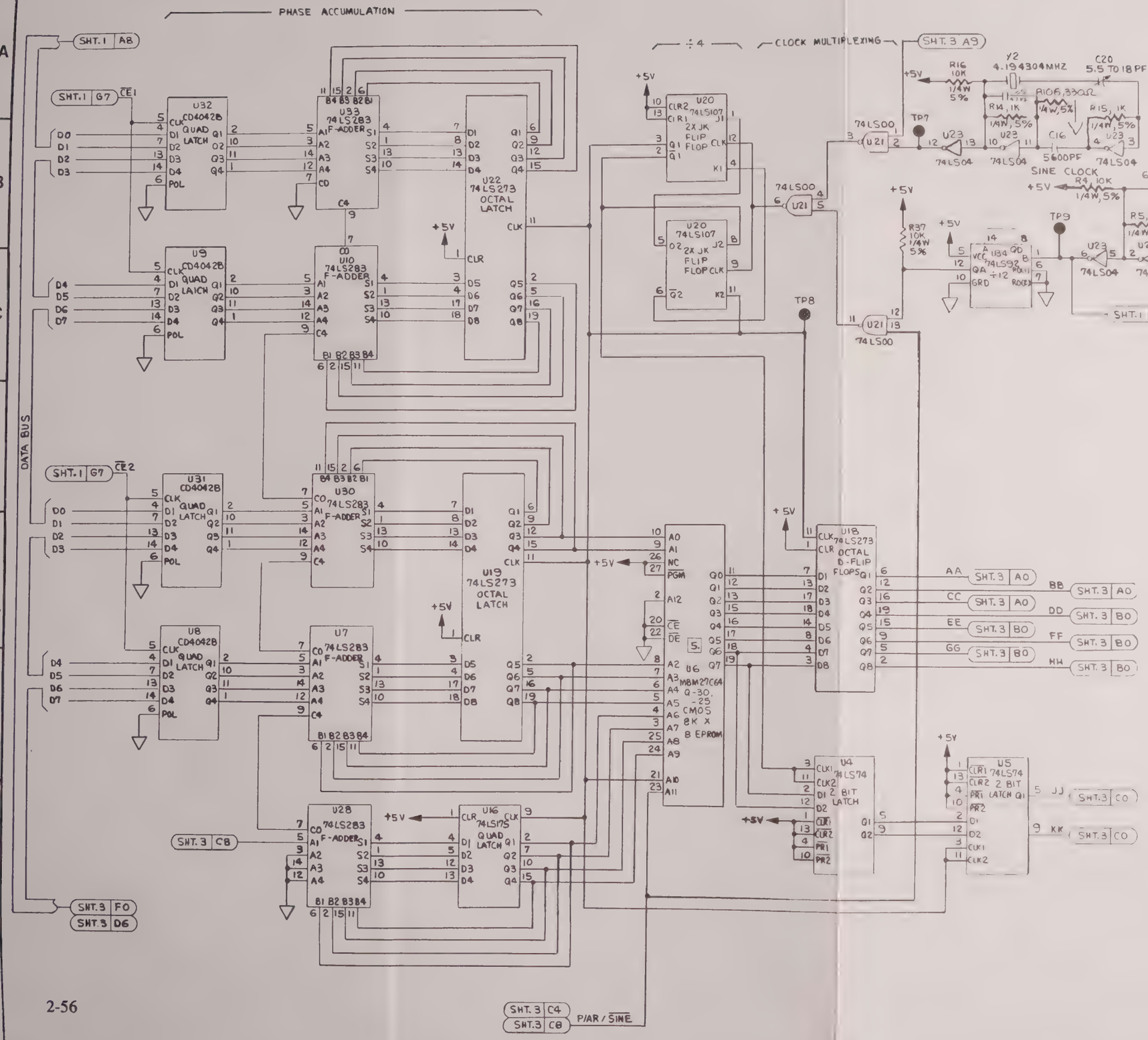
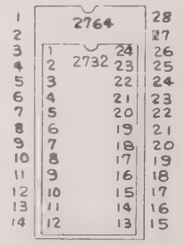


Figure 2.6-15 Sheet 1 of 3 Schematic Processor Board



NOTES : UNLESS OTHERWISE SPECIFIED

1. RESISTOR VALUES ARE MEASURED IN OHMS, 1/8W, 1%
2. CAPACITOR VALUES ARE MEASURED IN MICROFARADS, SEE PARTS LIST FOR VOLTAGES.
3. C1-7, 11-17, 30-35, 42, 43, 45, 47, 58, 60, 70, 71, 81 ARE DECOUPLING CAPACITORS VALUE .05UF.
4. DASH LINE (— —) DENOTES MECHANICAL CONNECTION OR INTERLOCK.
5. REFER TO DIAGRAM FOR PIN COMPATIBILITY BETWEEN A 2764, 2732



6. REFERENCE PARTS LIST A112500601.
7. WITH P/AR OPTION INSTALL J2, WITHOUT P/AR OPTION DO NOT INSTALL J2
8. 1004 HZ FILTER USED ON A112500601
   R59 = 200 K, R60 = 2.32K, R65 = 110K
   1020 HZ FILTER USED ON A112520017
   R59 = 196, 89K, R60 = 2.26K, R65 = 108.18 K.

Figure 2.6-15 Sheet 2 of 3
Schematic Processor Board

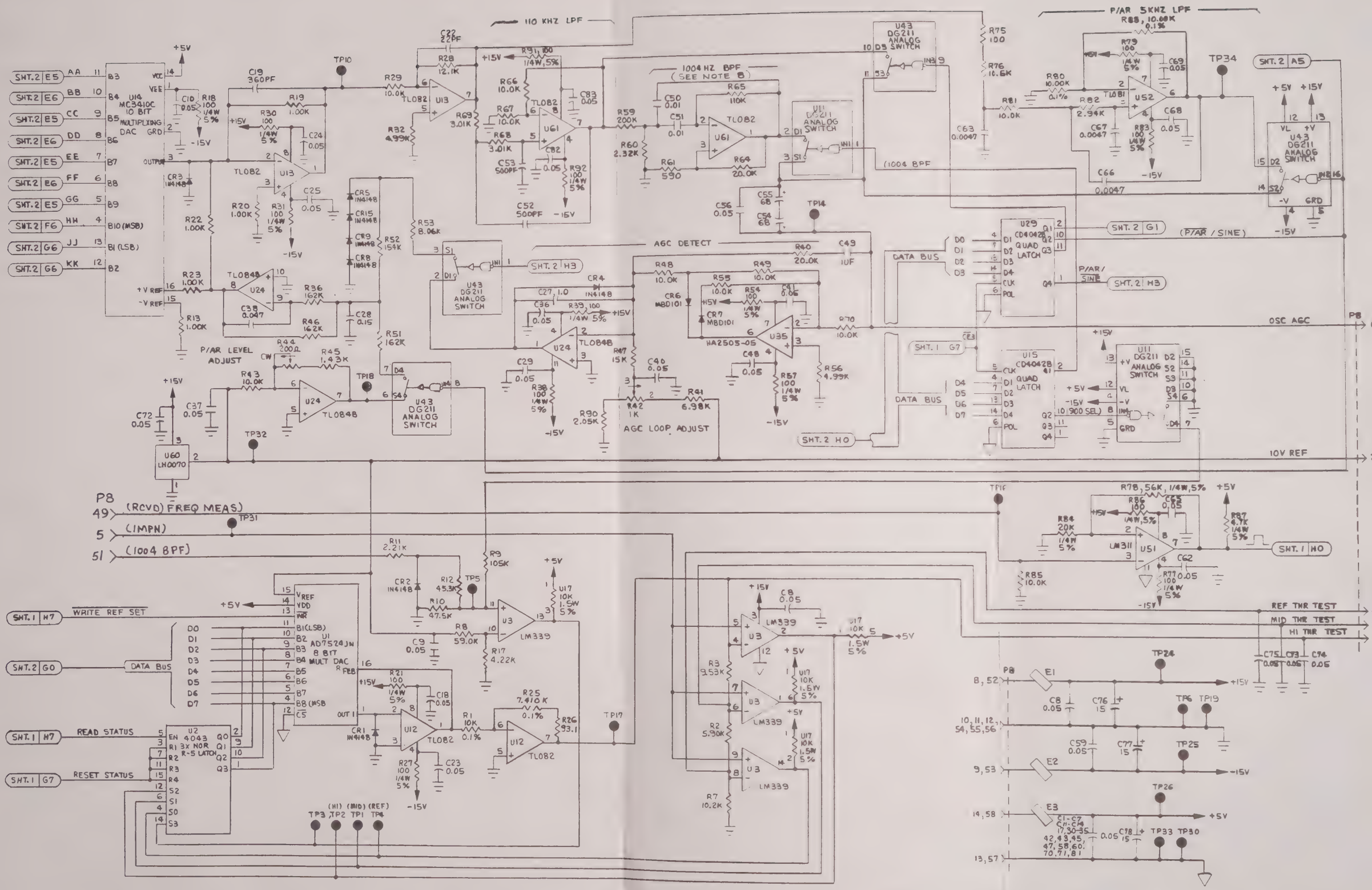
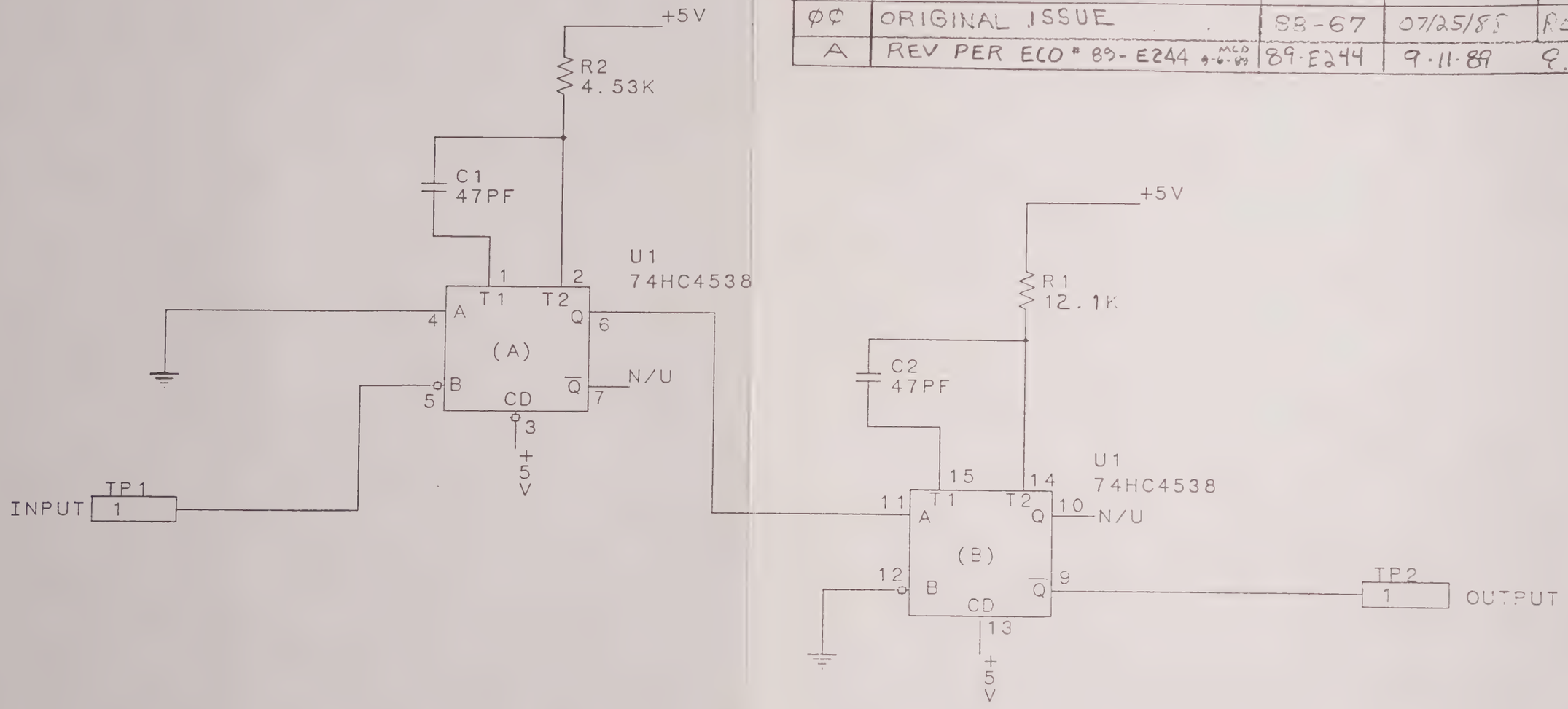


Figure 2.6-15 Sheet 3 of 3 Schematic Processor Board

REVISIONS				
REV	DESCRIPTIONS	ECO	DATE	APPROV.
ØØ	ORIGINAL ISSUE	88-67	07/25/88	RCJM
A	REV PER ECO # 89-E244 9-6-89 MLD	89-E244	9-11-89	C.W



A1125-01-701	1125E
A1125-00-046	1125
NEXT ASSY	USED ON
APPLICATION	

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES

.XX ± ~ .XXX ± ~

ANGLE ± ~

MATERIAL

		DATE
DRFTG DR	RCJM	04/19/88
APPD		
CHK	Saul	7/28/88
ENGRG DEV		
E/M		
PROJ		
MFG	DPO	7/29/88
QC	CTS	7/28/88

NORTHEAST ELECTRONICS
DIVISION OF
TAU-TRON INC
57 REGIONAL DRIVE CONCORD, NH 03301

SCHEMATIC

1125 PROCESSOR WR DELAY PIGGY BACK

SIZE	DWG NO	REV
B	R1125 00 346	A
SCALE		SHEET 1 OF 1

Figure 2.6-15 Sheet 3 of 3 Schematic Processor Board

2.7 V/F BOARD

2.7.1 Scope:

This section explains the functions of the V/F circuit board, summarizes its operation, and describes its circuits. For reference purposes, it includes block diagrams, a component layout drawing, and a schematic.

A. FUNCTIONS AND CIRCUITRY

2.7.2 Functions:

The V/F Board is used primarily for:

- Filtering signal noise
- Amplifying the signal after filtering
- Detecting the received signal and converting its AC inputs to DC outputs
- Setting the oscillator level designated by the user

See Figure 2.7-1 for a block diagram of these functions.

2.7.3 Circuits:

Corresponding to the functions named above, the various V/F board circuits operate in the following ways, depending on which function requires execution. (Alphanumeric codes, such as U27, identify certain components in the Component Location and Schematic drawings, Figures 2.7-8 and 2.7-9.)

2.7.4 Filter Circuitry:

For noise measurement, the signal input from the I/O board is filtered on the V/F board, but for level and frequency measurement, the signal is not passed through any of the six filters on the V/F board. If noise measurement is desired, the microprocessor (on the processor board) controls the multiplexer (U27) selection of the desired filter and routes the signal to the proper filter (Figure 2.7-2):

- C-Message Filter. This filter (U36) consists of four second-order networks. The first is a high-pass network, the second is a band-pass network, and the third and fourth are low-pass networks. As the signal leaves these networks, and adjustable potentiometer (R138) set filter gain at 1kHz to 0 dB.
- 3 kHz Filter and 15 kHz Filter. These are second-order Butterworth low-pass filters (U37). The first uses a 3dB cutoff frequency of 3 kHz. The second uses a 3dB cutoff frequency of 15 kHz.
- P/AR Filter. This filter (U31, U32) consists of two band-pass filters in cascade, having identical poles and zeros.
- 50 k-Bit Filter. This filter (U34, U35) has a high-pass network, two low-pass sections, and a low-pass network with a notch. It has a 3dB cutoff frequency of approximately 30 kHz.
- Program Filter. This filter (U33) has three second-order low-pass cascaded sections and one second-order high-pass section.

Note: To conserve battery power, the supply to any of these filters (C-Message, P/AR, 50k-Bit, or Program), is shut off when that filter is not selected.

After the noise filtering process is concluded, the analog multiplexer (U27) routes the filtered output to the autorange circuitry for further processing.

2.7.5 Autorange Circuitry:

The autorange circuitry (Figure 2.7-3) amplifies the output of the filters, treating level as a flat filter. Filter output is amplified in steps of 10 dB, from -10dB to 60dB (Figure 2.7-3). The microprocessor checks for this output of the detectors and sets the appropriate gain of autorange circuitry.

2.7.6 Detector Circuitry:

After autoranging takes place, the detector circuits convert AC inputs to DC output levels proportional to the input signal levels. The output of the multiplexer is further amplified by 10 dB before being passed through a 110 kHz low-pass filter (U23). (See Figure 2.7-3.)

Note: To reduce cross talk, ports S1 and S2 of the multiplexer are grounded when detectors U24 and U25 are not in use.

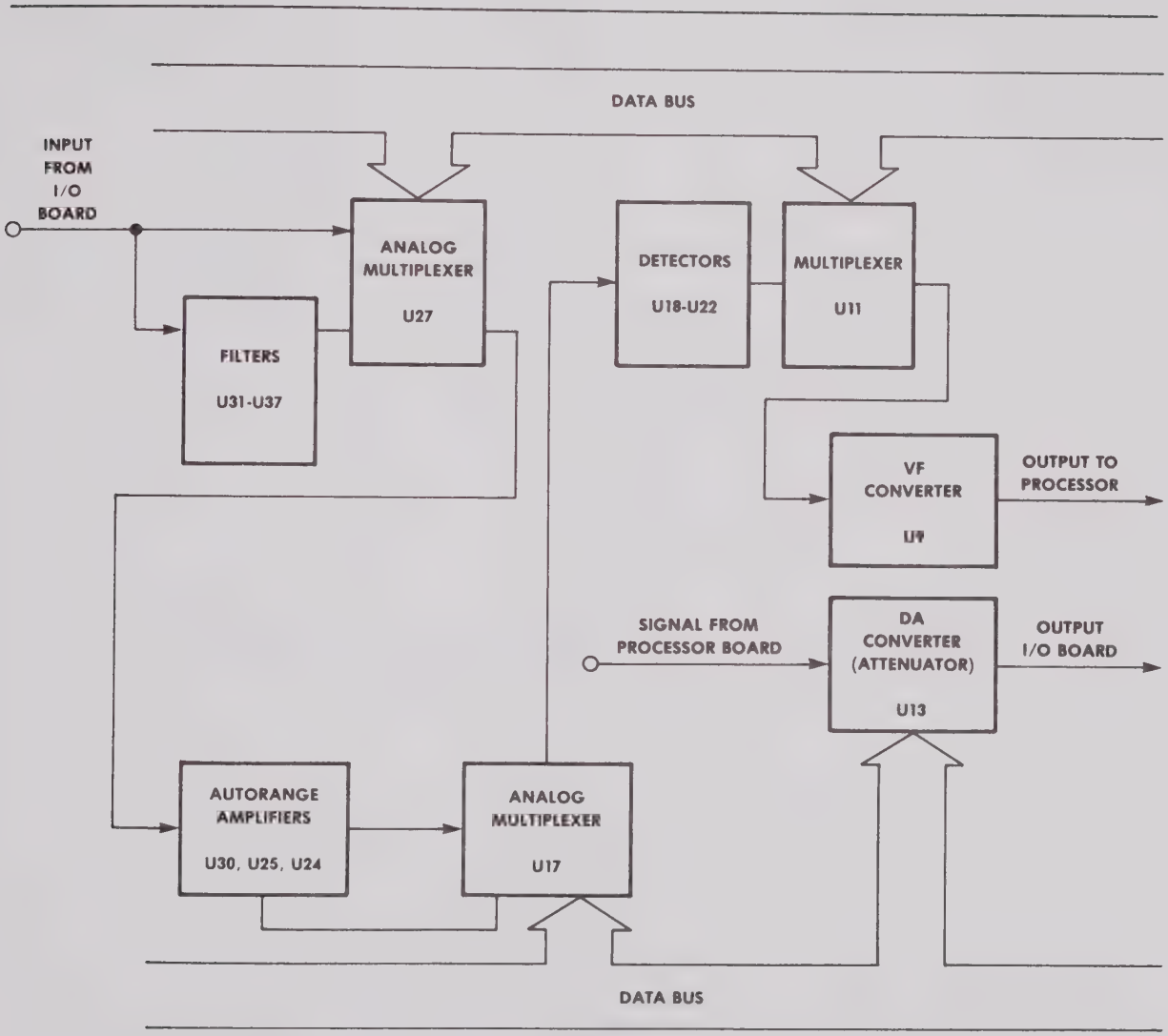


Figure 2.7-1 Block Diagram of V/F Board Functions

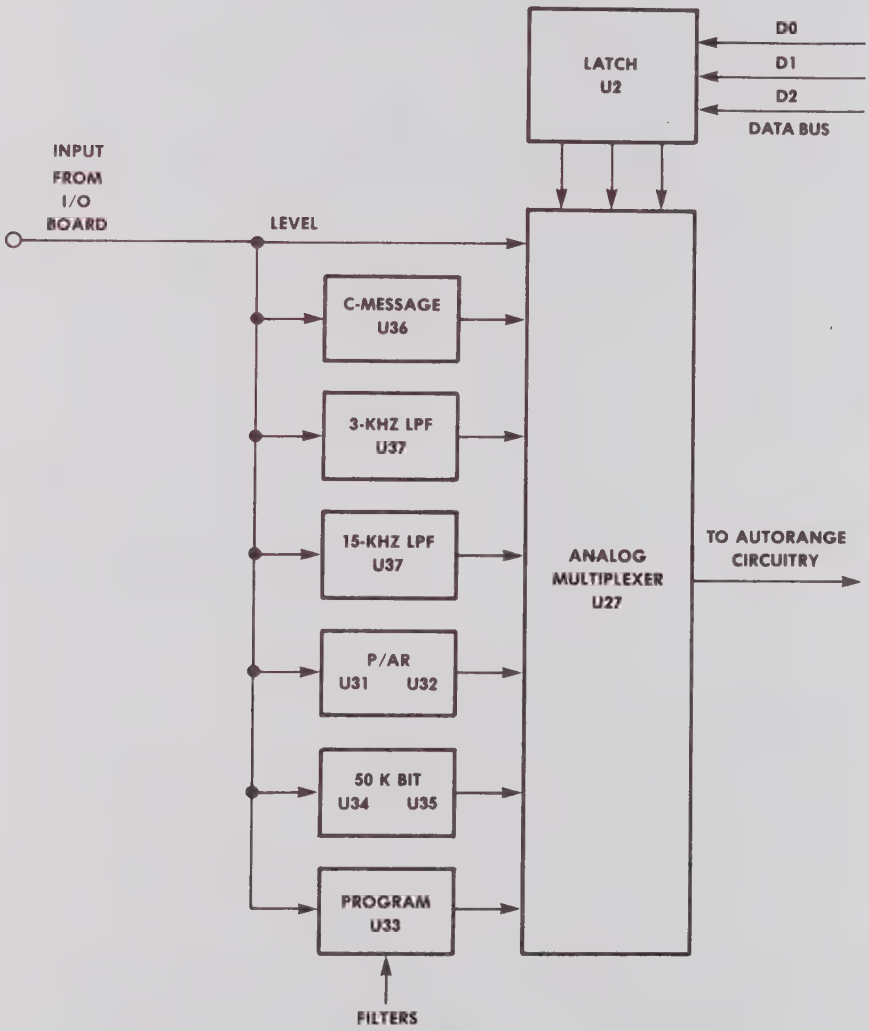


Figure 2.7-2 Block Diagram of the Filter Circuitry

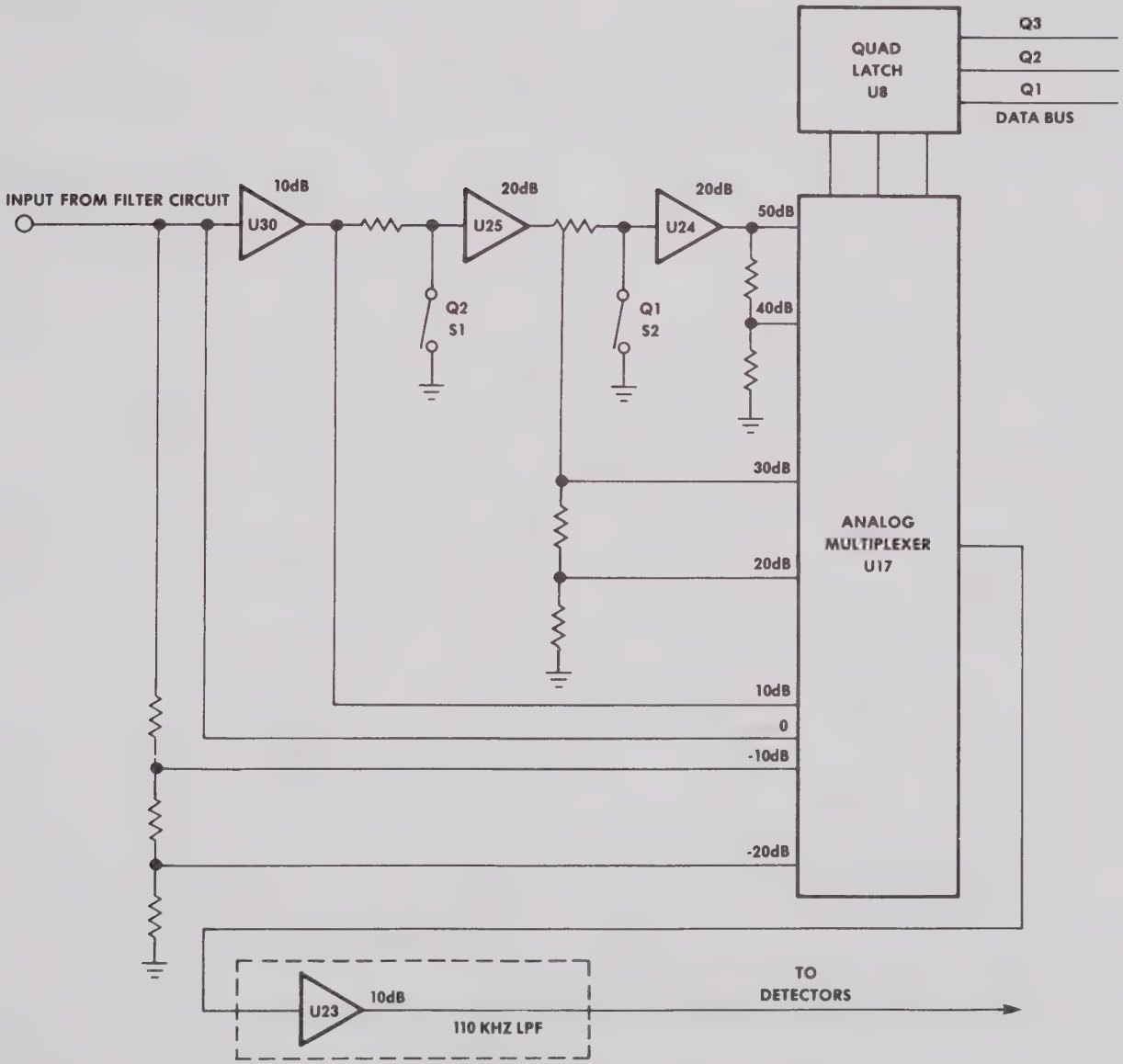


Figure 2.7-3 Block Diagram of the Autorange Circuitry

2.7.7 The Model 1125 uses three different detectors: (1) full wave average (U21), (2) quasi RMS (U18, U19, U20), and (3) peak (U22). (See Figure 2.7-4.) All of the detectors require a full-wave rectified signal. This full-wave rectified signal is generated by adding the input AC signal to a half-wave rectified signal of twice the peak amplitude.

- The average detector output is the full-wave rectified signal passed through the low-pass filter.
- The quasi RMS detector is generated the same way as the average detector with the addition of scaled signals from positive and negative peak detectors (The positive peak detector is inverted before being added.).
- The peak detector uses the full-wave rectifier to generate a DC level equal to the peak input voltage.

2.7.8 The desired detector output is selected by the analog multiplexer and sent to the voltage-to-frequency converter so that it can be measured by the control circuitry associated with the microprocessor. Although the V/F converter has excellent linearity, it lacks absolute accuracy. To get the required accuracy, the microprocessor calibrates the converter using the built-in 10-volt reference supplied by the processor board. At this point, the signal measurements to be displayed are computed by the microprocessor according to the receiver impedance selected on the front panel.

2.7.9 Oscillator Attenuator Circuitry:

The Oscillator function on the V/F board is separate from the board's filter, autorange, and detection functions. The V/F board oscillator circuitry (Figure 2.7-5) gets its input from the AGC circuitry of the processor board (see Section 2.6), and it passes its output to the I/O board for final processing (see Section 2.8).

2.7.10 The oscillator circuitry sets the oscillator level designated by the operator. The oscillator level in the 1125 is keypad programmable from -40 dBm to +10 dBm with a resolution of 0.1dBm. This is achieved by using a 12-bit digital-to-analog converter (U13). The signal from the processor board is fixed at 3.47 volts RMS, and the 12-bit code for the desired output level is set at digital-to-analog inputs using latches U4, U5, U6, and U7.

B. DRAWINGS AND PARTS LIST

2.7.11 Board Layout:

For the physical location of V/F board components, refer to the Component Location Drawing that follows the parts list in this topic. (Figure 2.7-8).

2.7.12 Schematic:

For circuit details, refer to the schematic for the V/F board at the end of this topic. (Figure 2.7-9).

2.7.13 V/F BOARD CALIBRATION

2.7.14 Functions and Circuits Scope:

This topic gives instructions for setting up and conducting the following procedures for the Model 1125 VF circuit board:

- Check several FILTERS
- Calibrate the P/AR FILTER
- Calibrate the P/AR UNITS
- Calibrate the LEVEL REFERENCE
- Check the C-MESSAGE FILTER

Table 2.7-A lists the test points to be used and the associated calibration adjustment devices. Figure 2.7-6 shows their locations on the VF board.

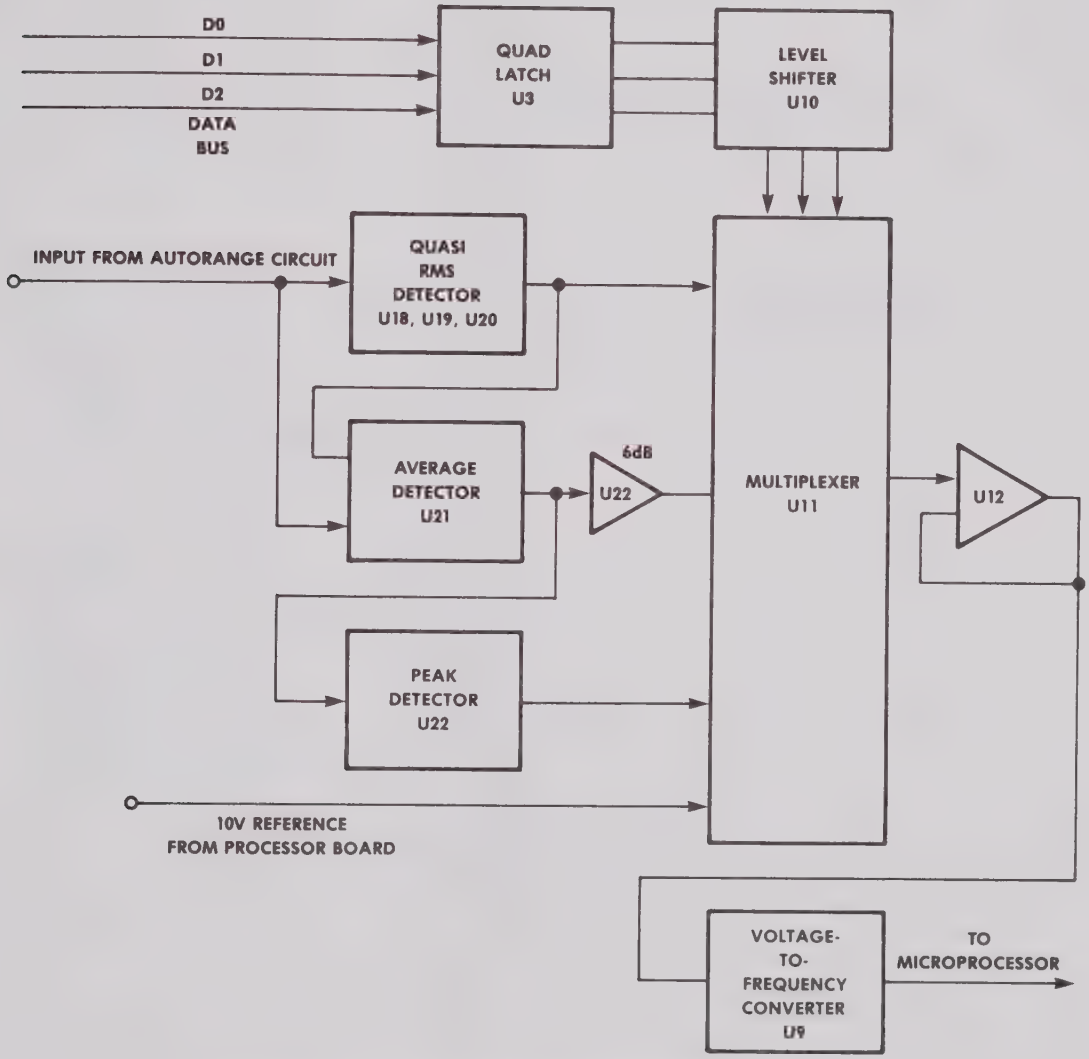


Figure 2.7-4 Block Diagram of the Detector Circuitry

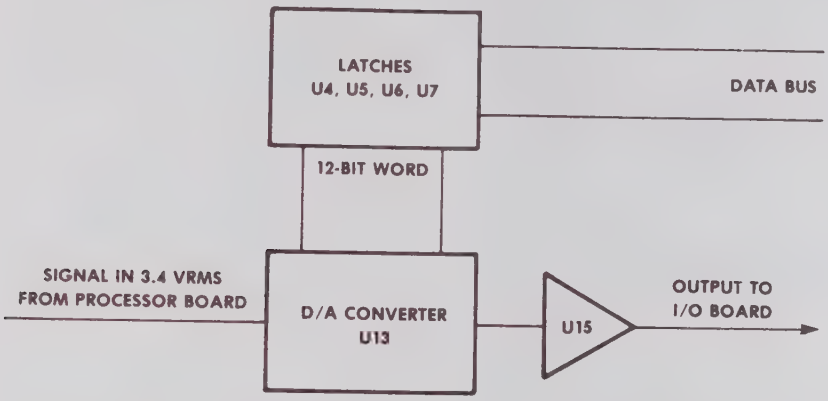


Figure 2.7-5 Block Diagram of the Oscillator Attenuator Circuitry

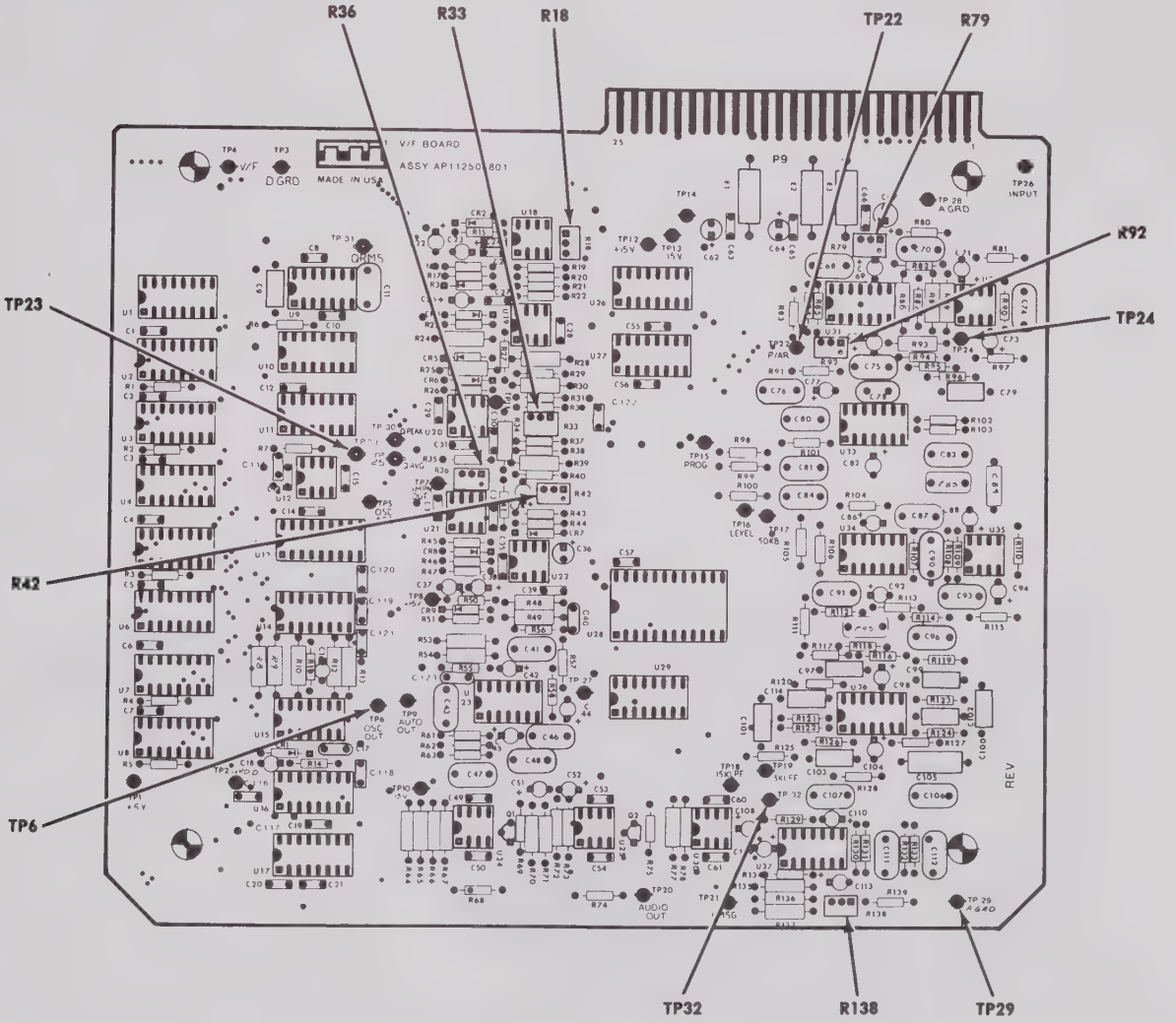


Figure 2.7-6 VF Board Calibration Locations

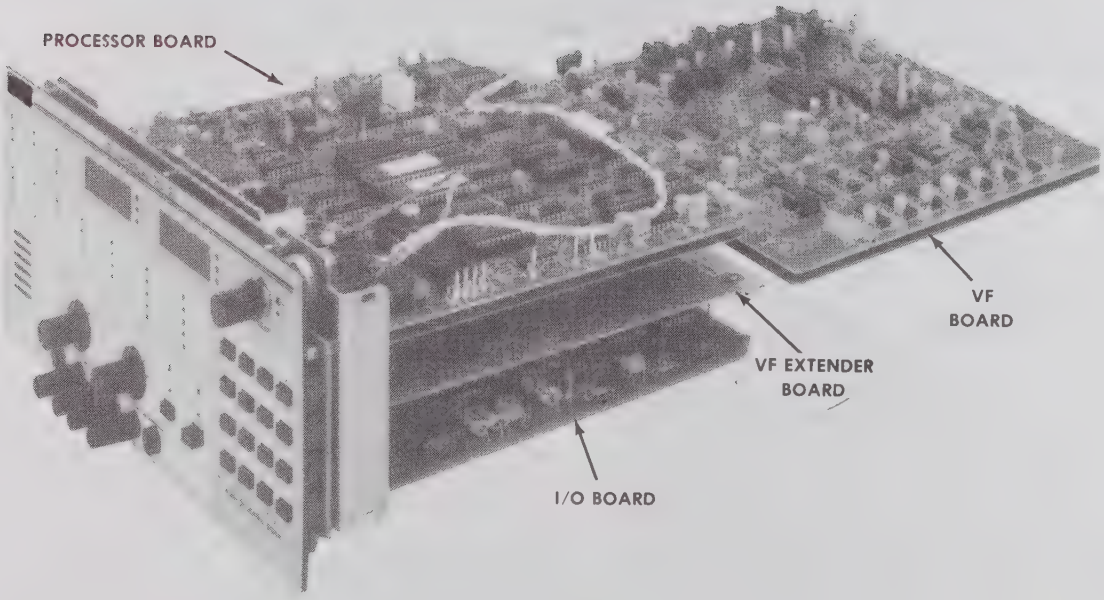


Figure 2.7-7 Setup for VF Board Extended

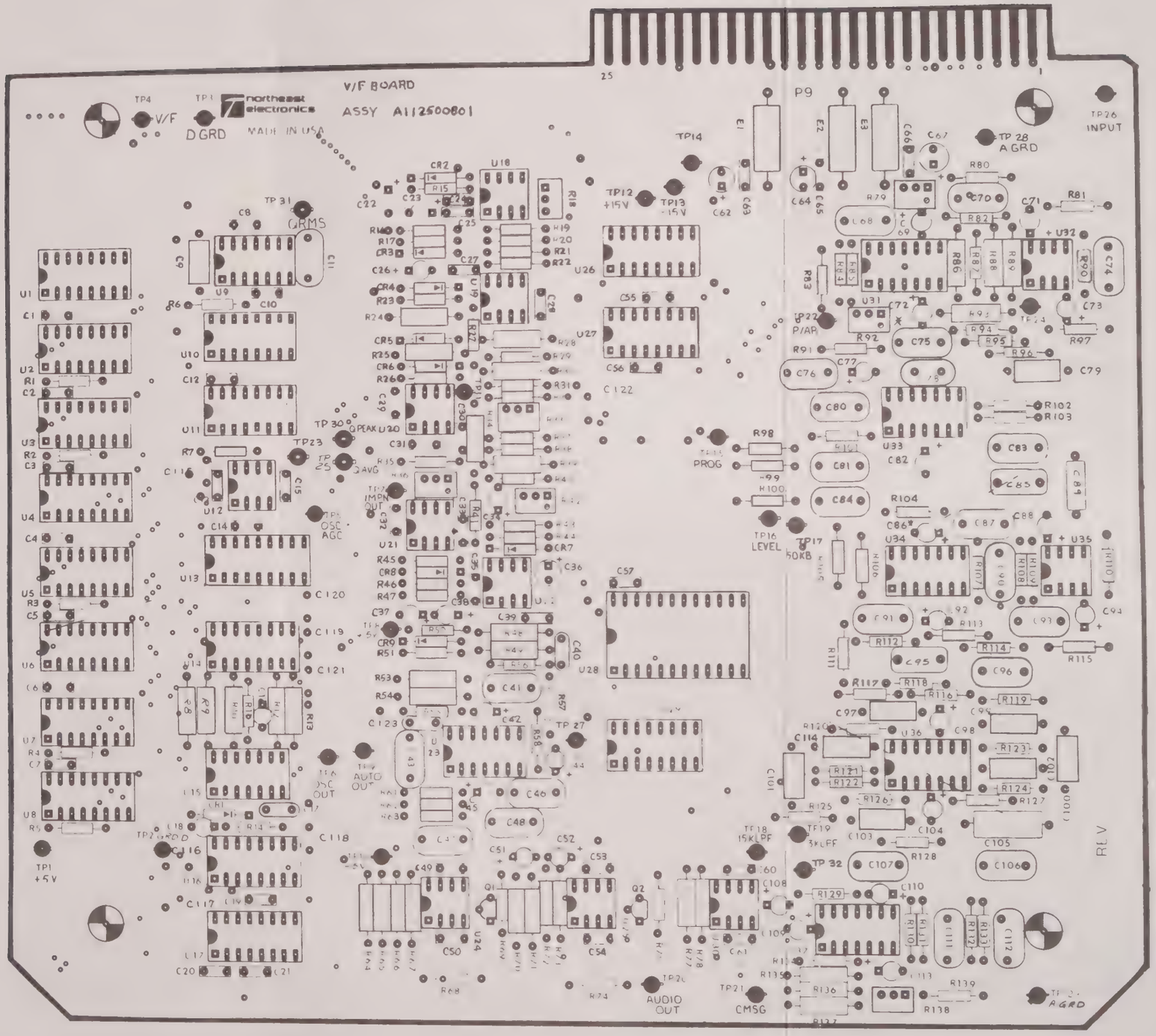


Figure 2.7-8 Component Location Drawing V/F Board

C-MESSAGE FILTER

3KHZ LPF

15KHZ LPF

U3.U4 = 50K BIT FILTER

PROGRAM FILTER

P/AR. FILTER

NOTES : UNLESS OTHERWISE SPECIFIED

1. REFERENCE PARTS LIST A 112500801.
2. RESISTOR VALUES ARE MEASURED IN OHMS, 1/8W, 1 %.
3. CAPACITOR VALUES ARE MEASURED IN MICROFARADS, SEE PARTS LIST FOR VOLTAGES.
5. DASH LINE (— —) DENOTES MECHANICAL CONNECTION OR INTERLOCK.

V/F BOARD SCHEMATIC
R112500308 REV C
SHT 1 OF 4

Figure 2.7-9 Sheet 1 of 4 Schematic V/F Board

SHT. 4 | D0 — DATA BUS — D4 D5 D6 D7 — U8 CD4042B QUAD LATCH — Q3 Q2 Q1 — $\overline{Q1}$ $\overline{Q4}$

P9 — AUTOR SEL EN — 44

R5 100K 1/4W 5%

+5V — C7 0.05

SHT. 1 | F7 — C109 10 — C108 10

R135 6.838K 0.1%

R136 2.162K 0.1%

R137 1K 0.1%

LF351 U30 — C61 0.05 — -15V

+15V — C60 0.05

R75 10K

R77 6.838K 0.1%

R78 3.162K 0.1%

Q2 2N5210

R74 10K 1/4W 5%

HA2505 U25 — C54 0.05 — -15V

+15V — C53 0.05

C52 10 — C51 10

R72 10K 0.1%

R73 1.11K 0.1%

R70 6.838K 0.1%

R71 3.162K 0.1%

R69 10K

Q1 2N5210

R68 10K 1/4W 5%

HA2505 U24 — C50 0.05 — -15V

+15V — C49 0.05

R66 .1K 0.1%

R67 1.11K 0.1%

R65 6.838K 0.1%

R64 3.162K 0.1%

200B — 400B — 800B — 1000B — -1000B — -200B

U17 DG508 ANALOG_V MULT — A2 A1 A0 — EN — +V — S8 S7 S5 S6 S4 S3 S2 S1 — D — GRD

+15V — C19 0.05

+5V — C20 0.05

-15V — C21 0.05

TP9

TP20

P9 — VOL HIGH

AUTO RANGING CIRCUIT

110KHZ LPF

R53 3.162K 0.1%

LF347 U23

R54 6.838K 0.1%

C123 110PF

R51 1.65K

C41 1700PF

R56 1.65K

C40 82PF

LF347 U23

R57 619

C48 1200PF

R58 619

C46 1100PF

LF347 U23

R62 845

L43 1200PF

R63 845

C47 620PF

LF347 U23

R61 100 1/4W, 5% — +15V

C45 10

R55 150 1/4W, 5% — -15V

C42 10

C44 10

TP27

REC FREQ MEAS

SHT. 3 | C0

V/F BOARD SCHEMATIC
R112500308 REV C
SHT 2 OF 4

Figure 2.7-9 Sheet 2 of 4 Schematic V/F Board

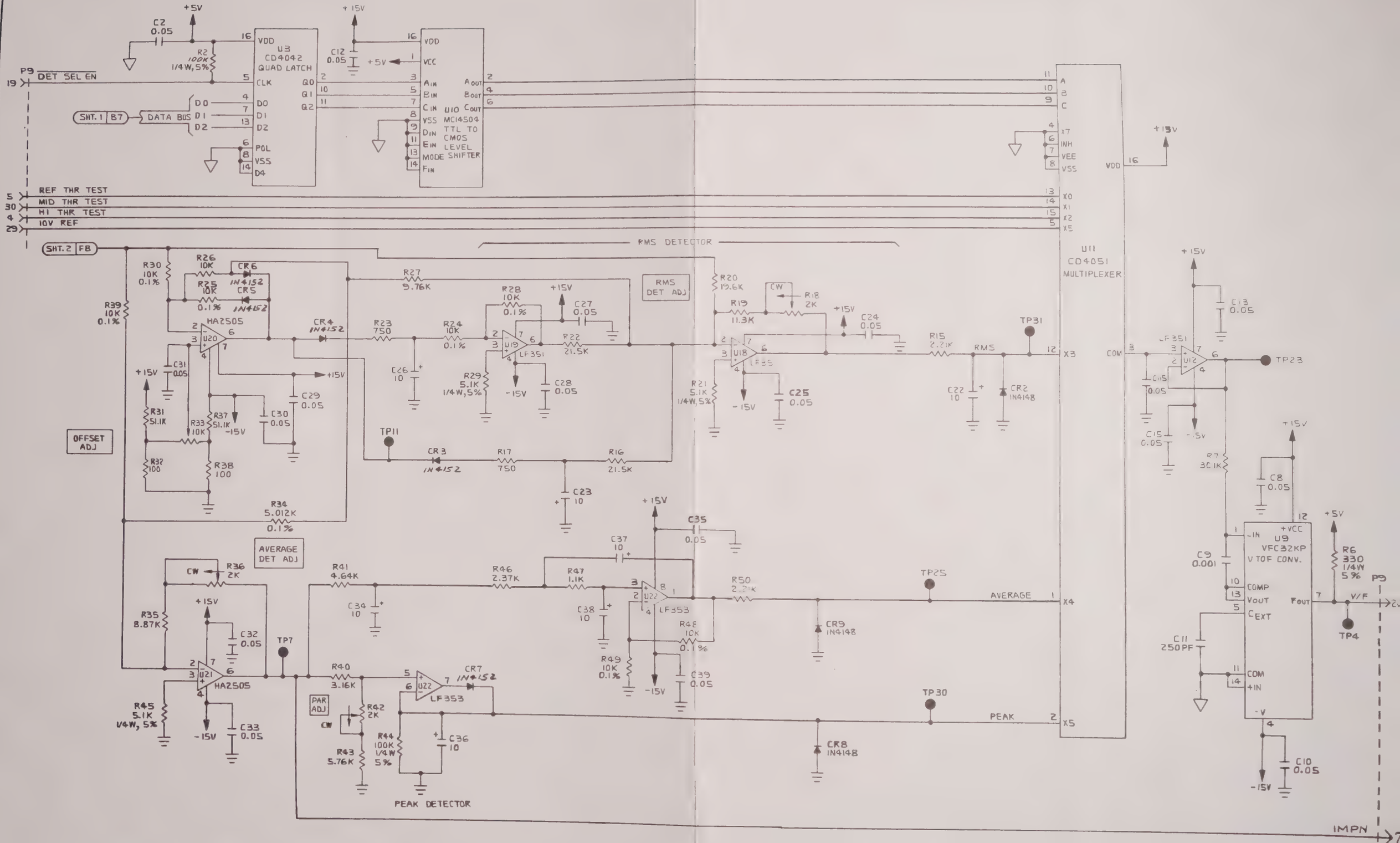


Figure 2.7-9 Sheet 3 of 4 Schematic V/F Board

P9
25 D0
50 D1
24 D2
49 D3
23 D4
48 D5
22 D6
47 D7
DATA BUS
U1
100K
+5V
C6 0.05
R4 100K 1/4W 5%
17 CE 5
U7 CD4042 QUAD LATCH
C5 0.05
SHT.2 A0
U6 CD4042 QUAD LATCH
C3 0.05
R3 100K 1/4W 5%
43 CE4
U4 CD4042 QUAD LATCH
C4 0.05
SHT.1 B7
U5 CD4042 QUAD LATCH
TP5
8 OSC AGC
+15V +5V
C120 0.05
C119 0.05
U14 DG211 ANALOG SWITCH
C121 0.05
-15V
R12 10K 0.1%
R13 1.111K 0.1%
LF347
R8 8.838K 0.1%
R9 2.162K 0.1%
R10 1.0K 0.1%
C116 0.05
C118 0.05
U16 DG211 ANALOG SWITCH GRD
C117 0.05
R6 .CO 4W 5%
C8 10
C14 0.05
U13 AD7541 CMOS 12 BIT MULTIPLYING DAC
CR1 IN4148
C17 22PI
C16 10
R11 100 1/4W 5%
TP6
OSC
P9 33

V/F BOARD SCHEMATIC
R112500308 REV C
SHT 4 OF 4

P9
10,35
3,9, 12,13, 14,28, 31,34, 37-39
11,36
16,41
15,21, 40,42, 45,46 2,27
E3
E2
E1
C66 0.05
C67 10
C64 10
C65 0.05
C62 10
C63 0.05
TP8 TP12 TP28 TP29 TP10 TP13 TP14 TP1 TP2 TP3
+15V
-15V
+5V

Figure 2.7-9 Sheet 4 of 4 Schematic V/F Board

TABLE 2.7-A
VF BOARD TEST POINTS AND ADJUSTMENTS

TEST POINT (TP)	FUNCTION	ADJUSTMENT (R) OR (C)	FUNCTION
TP 29	Analog ground		
TP 32	Multiplexed output from filters.		
TP 24	P/AR filter (Phase I) output	R 79	Adjusts P/AR filter (Phase I)
TP 22	P/AR filter (Phase II) output	R 92	Adjusts P/AR filter (Phase II)
TP 23	Multiplexed output from detectors	R 18	Adjusts gain for RMS detector
		R 42	Adjusts gain for peak detector
TP 6	DAC output for sinewave and P/AR	R 36	Adjusts gain for average detector
		R 33	Adjusts offset for peak, average, and RMS detectors
		R 138	Adjusts C-Message gain at 1 kHz.
See WARNING about R138 in paragraph 2.7.39			

2.7.15 Setup:

Before testing and calibrating the VF board, follow these steps to set up equipment:

(1) Turn off the Model 1125 power switch and disconnect the power cable from the external power source.

(2) Disconnect the ends of the test cables connected to the Model 1125.

(3) Disconnect the two cable assembly connectors going to the inside rear panel and the power supply of the Model 1125.

(4) Remove the I/O board from the extender board and remove the extender board from the mother board slot so that the two dial shafts protrude through their proper holes to the front of the display panel.

(5) Refasten the two dials with screws provided.

(6) Remove the VF board from its slot and insert the VF extender board into the VF slot of the mother board. Then connect the VF board to the extender board, supporting it it necessary with some non-conducting article, such as a plastic spool or a ceramic object of the right height (Figure 2.7-7).

(7) Reconnect the Model 1125 cable connectors to the inside rear panel and power supply of the Model 1125.

(8) Turn on the Model 1125 power switch and again note any failure messages as the set runs through the self-test routine.

A. FILTER CHECKS

2.7.16 These tests do not involve a calibration adjustment; their purpose is to check the voltage output of several of the filters. If a result of +/- 1 volt RMS is not obtained for any of the filters tested here, try the same test a second time. If the result is still unsatisfactory, call Northeast Electronics Repair Service.

2.7.17 Calibration Equipment:

This calibration requires the following equipment:

- Hewlett-Packard 3456A Digital Voltmeter or its equivalent
- Fluke 5200A Programmable AC Calibrator or its equivalent
- Test cable with a dual-banana plug at one end and two alligator clip leads at the other
- Test cable with a dual-banana plug at one end and a 310 jack at the other.

2.7.18 Setup:

Before checking these filters on the VF board, make these set-up changes:

(1) Remove the digital voltmeter cable from the banana-plug resistor and set it aside. Then remove the banana plug resistor from the voltmeter. Insert the cable's dual-banana plug into the same voltmeter jacks, with the ground prong in the LO jack.

(2) Clip the voltmeter cable ground lead (black) to test point TP 29 on the VF board.

(3) Clip the voltmeter high-side cable lead (red) to TP 32 on the VF board.

(4) Remove the cable connecting the AC calibrator and the Model 1125. Replace it with a cable having a dual-banana plug at one end and a 310 jack at the other. Insert the 310 jack in the 1125 A pair jack, and the dual-banana plug to the output of the AC calibrator.

2.7.19 Initial Setting:

This calibration requires this initial setting:

Adjust the calibrator dials to get a reading on the display of 1.00000 volts RMS at 1.000 kHz.

2.7.20 Check Filters:

To check these filters for voltage output, follow the instructions given in Chart 2.7-B.

CHART 2.7-B
CHECK SEVERAL VF FILTERS

STEP	ACTION	FUNCTION	INDICATORS
1	ENTER [14] on the 1125 keypad Check voltmeter	Selects 1125 display to show receive measurements	REC LED lights 1+/-.05 volt RMS on voltmeter display
2	ENTER [22] Check voltmeter	Selects C-Message filter	CMSG LED lights 1+/-.05 volt RMS on voltmeter display
3	ENTER [23] Check voltmeter	Selects 3kHz Flat filter	3 kHz LED lights 1+/-.05 volt RMS on voltmeter display
4	ENTER [24] Check voltmeter	Selects 15kHz Flat filter	15kHz LED lights 1+/-.05 volt RMS on voltmeter display
5	ENTER [25] Check voltmeter	Selects Program filter	PROGR LED lights 1+/-.05 volt RMS on voltmeter display.
6	ENTER [26] Check voltmeter	Selects 50 kBit wideband filter	50 kB LED lights 1+/-.05 volt RMS on voltmeter display.

B. P/AR FILTER CALIBRATION (R79, R92)

2.7.21 Calibration Equipment:

No equipment change.

2.7.22 Setup:

Before calibrating the P/AR filter on the VF board, make this setup change:

Move the voltmeter high-side cable lead (red) to test point TP 24 on the VF board.

2.7.23 Initial Settings:

This calibration requires this initial setting:

Set CAL to read 1 volt RMS at 0.300 kHz.

2.7.24 Calibrate P/AR Filter:

To calibrate the P/AR filter on the VF board, follow the instructions given in Chart 2.7-C.

CHART 2.7-C
CALIBRATE P/AR FILTERS

STEP	ACTION	FUNCTION	INDICATORS
1	ENTER [12] on the 1125 keypad	Selects peak-to-average ratio (P/AR) measurements	P/AR LED lights
2	Adjust R79 on VF board to volts shown in right column.	Calibrates P/AR filter (Phase I)	.232+/-.002 volts RMS reading on multi-meter display
3	Move voltmeter high-side cable lead to TP22 on VF board. Leave calibrator set as before.	Setup to adjust R92	
4	Adjust R92 on VF board to volts shown here	Calibrates P/AR filter (Phase II).	.0491+/-.001 volts RMS reading on voltmeter display

C. P/AR UNITS CALIBRATION (R18, R36, R42)

2.7.25 Calibration Equipment:

No equipment change.

2.7.26 Setup:

Before calibrating the P/AR units on the VF board, make this setup change:

Move the digital voltmeter high-side cable lead to TP 23 on the VF board.

2.7.27 Initial Settings:

This calibration requires these initial dial or switch settings:

(1) Press the voltmeter DCV function key.

(2) Set the calibrator dials to get .774596 volts RMS at 1kHz.

(3) ENTER [10} on the 1125 keypad to activate the TMS measurement mode.

(4) The voltmeter display should read 4.43+/-.01 volts DC.

2.7.28 Calibrate P/AR Units:

To calibrate the P/AR units on the VF board, follow the instructions given in Chart 2.7-D.

2.7.29 Calibration Equipment:

As this calibration procedure continues, the digital voltmeter, but not the calibrator will be used. A loopback test cable with a 310 plug at each end will also be used.

2.7.30 Setup Change:

Before testing more P/AR units, change the equipment setup as follows:

(1) Disconnect the calibrator cable lead from the Model 1125 A pair jack.

(2) Insert a loopback cable with a single 310 plug at each end into the Model 1125 A pair and B pair jacks.

2.7.31 Calibrating P/AR Units Calibration:

To complete the P/AR units calibration, refer to Chart 2.7-D.

CHART 2.7-D
CALIBRATE P/AR UNITS

STEP	ACTION	FUNCTION	INDICATORS
1	ENTER [12] on the 1125 keypad	Selects peak-to-average ratio (P/AR) measurements	P/AR LED lights Or(out-of-range) reading on 1125 left display.
2	Adjust R18 on VF board to volts shown here	Calibrates gain for RMS detector.	2.260+/-.002 volts DC reading on the voltmeter.
3	ENTER [31]	Selects oscillator level function.	LEVEL SET LED lights.
4	Key in 0.0 on 1125 number pad level.	Sets transmission	0.0 dBm on 1125 left display.
5	Adjust R42 on VF board to volts shown here	Calibrates gain for peak detector.	100+/- 1 P/AR in right display, and 0.0 dBm in left display
6	Key in 8.0 on 1125 number pad	Resets the transmission level.	-8.0 dBm on 1125 left display.
7	Adjust R36 on VF board to P/AR shown here	Calibrates gain for average detector.	100+/- 1 P/AR in right display, and 8.0 dBm in left display.
8	Key in 0.0 again on number pad.	Ensures P/AR is still 100.	100 P/AR at 0.0 dBm in 1125 displays
9	Repeat steps 5-8 until P/AR of 100+/-1 is always obtained.		

D. LEVEL REFERENCE CALIBRATION (R33)

Note: This calibration involves a standard of error. The Fluke 5200A Programmable AC Calibrator has a built-in device to set an error range. For that calibrator, follow the calibration procedure given in Chart 2.7-E. If the calibrator being used does not have the offset error function, use dBm values and measurements. In that case, follow the calibration procedure given in Chart 2.7-F.

2.7.32 Calibration Equipment:

This calibration requires the following equipment:

- Hewlett-Packard 3456A Digital Voltmeter or its equivalent
- Fluke 5200A Programmable AC Calibrator or its equivalent
- Test cable with a dual-banana plug at one end and a 310 plug at the other end.

2.7.33 Initial Settings:

This calibration requires these initial dial or switch settings:

(1) Set the digital voltmeter to ACV.

(2) Turn on the Model 1125 power switch.

(3) The voltmeter display should read 1.097+/-.01 volts RMS.

2.7.34 Calibrate Level Reference:

To adjust the Model 1125 level offset, follow the steps in either Chart 2.7E or Chart 2.7-F, depending on the type of calibrator used. (See Note, above).

2.7.35 Setup:

Before calibrating the level reference, follow these steps:

(1) Turn off the Model 1125 power switch.

(2) Remove the loopback cable from the two 1125 jacks and reinsert the 310 connector from the calibrator into the 1125 A pair jack.

(3) Change the voltmeter high-side cable to TP 6.

CHART 2.7-E
CALIBRATE LEVEL REFERENCE
(for calibrator with error setting)

STEP	ACTION	FUNCTION	INDICATORS
1	ENTER [14].	Sets 1125 display to show receive measurements.	REC LED lights.
2	Set calibrator error measurement button to ERROR RANGE x1 and set % arrow to 0.0	Calibrator applies this error measurement to the 1125	Calibrator x1 error range window lights
3	Change calibrator dial setting to -.7 volts RMS.		
4	Adjust R33 on VF board to level indicated.	Adjust offset for peak, average, and RMS detectors	Steady .1dBm in left display.
5	Change calibrator dial setting to +.7 volts RMS .	Calibrator outputs this voltage to the 1125.	.774596 reading on the calibrator. Steady -.1 dBm 1125 left display.

CHART 2.7-F
CALIBRATE LEVEL REFERENCE
(for calibrator without error setting)

STEP	ACTION	FUNCTION	INDICATORS
1	ENTER [14].	Sets 1125 display to show receive measurements.	REC LED lights.
2	Set calibrator dials to get .784595 volts RMS.	Calibrator outputs this voltage to the 1125. the calibrator.	.784595 volts RMS reading on
3	Adjust R33 on VF board to level shown here at the right.	Adjust offset for peak, average, and RMS detectors.	Steady .1dBm in 1125 left display.
4	Change calibrator dials to get .764596 volts RMS.	Calibrator outputs this voltage to the 1125.	.784596 volts RMS reading on the calibrator. Steady -.1 dBm 1125 left display.

E. C-MESSAGE FILTER CHECK (R138)

2.7.36 Calibration Equipment:

No equipment change.

2.7.37 Setup:

No change in setup.

2.7.38 Initial Settings:

This calibration requires these initial settings:

(1) Set the AC calibrator error % arrow to 0.0 and the ERROR RANGE button to x1.

(2) Set the calibrator dials to get .774596 volts RMS at 1kHz

2.7.39 Test C-Message Filter:

To test the C-Message filter for gain at 1 kHz, follow the instructions given in Chart 2.7-G.

CHART 2-G
CHECK C-MESSAGE FILTERS

STEP	ACTION	FUNCTION	INDICATORS
1	ENTER [14] on the 1125 keypad.	Selects 1125 display to show receive measure-ments.	REC LED lights
2	ENTER [22]. See WARNING.	Selects C-Message filter.	CMSG LED lights 90 dBm reading on left display.

WARNING

If a reading of 90 dBm is not obtained, try the test again. If the result is still not correct, DO NOT ATTEMPT TO CALIBRATE THE R138 ADJUSTMENT. Call Northeast Electronics Customer Service about returning the set for that adjustment.

2.7.40 The next step is to calibrate the Processor Board, as explained in Section 2.6.

2.7.41 Board Layout:

For the physical location of V/F board components, refer to the Component Location Drawing that follows the parts list in this topic. (Figure 2.7-8).

2.7.42 Schematic:

For circuit details, refer to the schematic for the V/F board at the end of this topic. (Figure 2.7-9).

2.8 I/O (INPUT/OUTPUT) BOARD

2.8.1 Scope:

This section explains the functions of the I/O circuit board, summarizes its operation, and describes its circuits. For reference purposes, it includes block diagrams, a component layout drawing, and a schematic.

A. FUNCTIONS AND CIRCUITRY

2.8.2 Functions:

The I/O board is used chiefly for:

- switching input and output signals
- selecting signals for measurement
- sensing termination impedances as they are selected
- capturing a telephone line for measurement
- filtering or amplifying certain signals
- providing an audio tone beep to announce a keyboard entry
- indicating a critically low battery voltage

See Figure 2.8-1 for a block diagram of these functions.

2.8.3 Operation and Circuits:

The I/O board circuits operate in the following ways, depending on which of the above functions require execution. See Figure 2.8-2.

2.8.4 Input and Output Switching:

When an operator uses the push-push TRANSFER switch on the Model 1125 front panel, the I/O board reverses the roles of the A and B jacks.

2.8.5 Signal Input Selection:

The operator selects which type of signal is to be measured, then analog switches U2 and U4 on the I/O board enable the signal selected. This is achieved by the microprocessor (on the Processor board) placing the correct data on the data bus (D0 to D7) and locking that information on latch U3.

2.8.6 Impedance Input Selection:

The Model 1125 is designed to work on lines of impedance of 135, 150, 600, 900 and 1200 ohms. On the reverse side, the impedance terminations are affected by resistors R1 to R5, on the transmit side by resistors R65 to R10. The operator selects an impedance using the front panel dial switches S2 and S3.

> **Note:** Where the line under test already has been terminated, the operator does not need to use the 1125 terminating impedances and can bridge the receive circuit using push-push switch S4. When bridged, the receiver circuitr of the 1125 presents a high input impedance (greater than 50k ohms).

When an operator selects a termination impedance using the switch on the front panel, the input of the switch is connected to the priority encoder chip U14. The microprocessor decodes the generated output code to determine the impedance value selected.

2.8.7 Line Capture:

An operator can capture a telephone line for measurement by simulating an "off-hook" condition. This is carried out by the receive side transistors Q1 through Q6 and the transmit side transistors Q8 through Q13 with their associated circuitry. An inductance can be simulated because a constant current source is produced when DC voltage is applied across the holding line and a high impedance is produced when AC voltage is applied across it.

2.8.8 Signal Filtering:

The I/O board contains two filters, a 1010 Hz Notch Filter and a 1.004 kHz Band Pass Filter (BPF).

- The 1010 Hz filter notches out the 1004 Hz signal (called the holding tone) which is applied to one end of the line in order to activate the companders and equalizers along the line. This is necessary in order to get significant and accurate test results. This notch filter consists of three bi-quad notch filters at 995, 1010, and 1025 Hz (U7 and U8).
- The output of the high gain 1 kHz BPF filter (U9) is compared with a set reference to determine the presence or

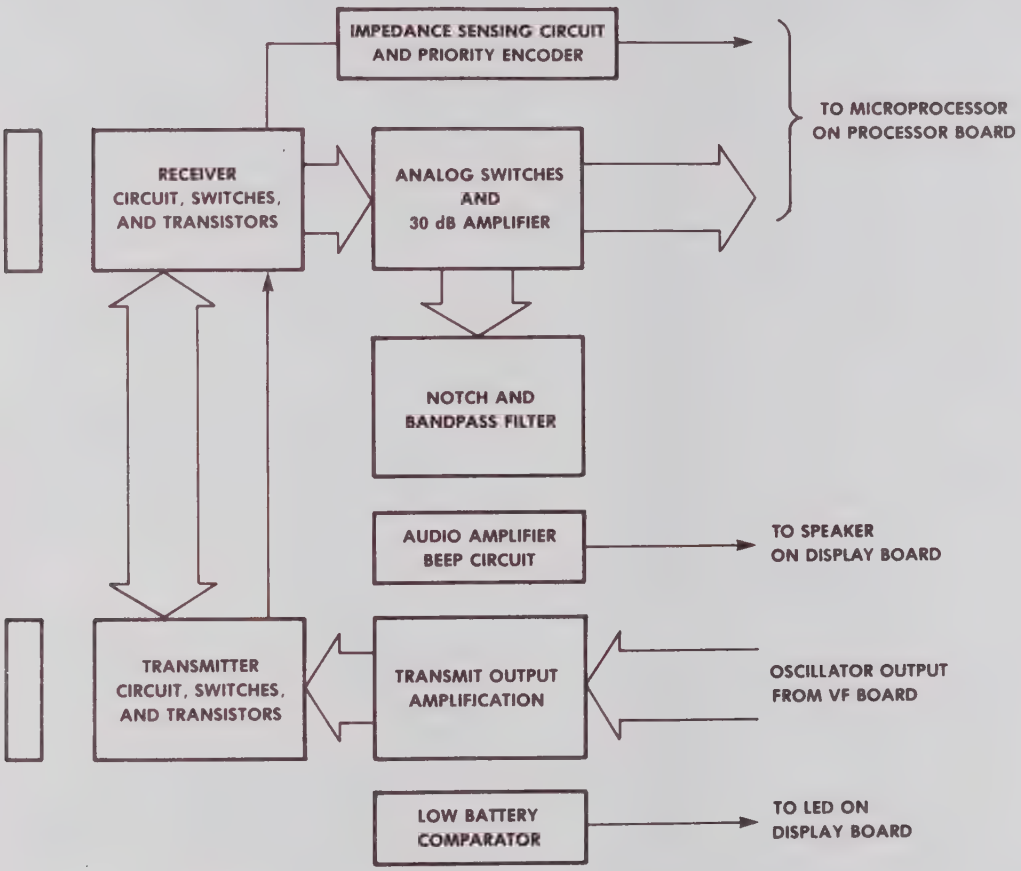

IMPEDANCE SENSING CIRCUIT AND PRIORITY ENCODER
TO MICROPROCESSOR ON PROCESSOR BOARD
RECEIVER CIRCUIT, SWITCHES, AND TRANSISTORS
ANALOG SWITCHES AND 30 dB AMPLIFIER
NOTCH AND BANDPASS FILTER
AUDIO AMPLIFIER BEEP CIRCUIT
TO SPEAKER ON DISPLAY BOARD
TRANSMITTER CIRCUIT, SWITCHES, AND TRANSISTORS
TRANSMIT OUTPUT AMPLIFICATION
OSCILLATOR OUTPUT FROM VF BOARD
LOW BATTERY COMPARATOR
TO LED ON DISPLAY BOARD

Figure 2.8-1 Block Diagram of I/O Board Functions

I/O BOARD

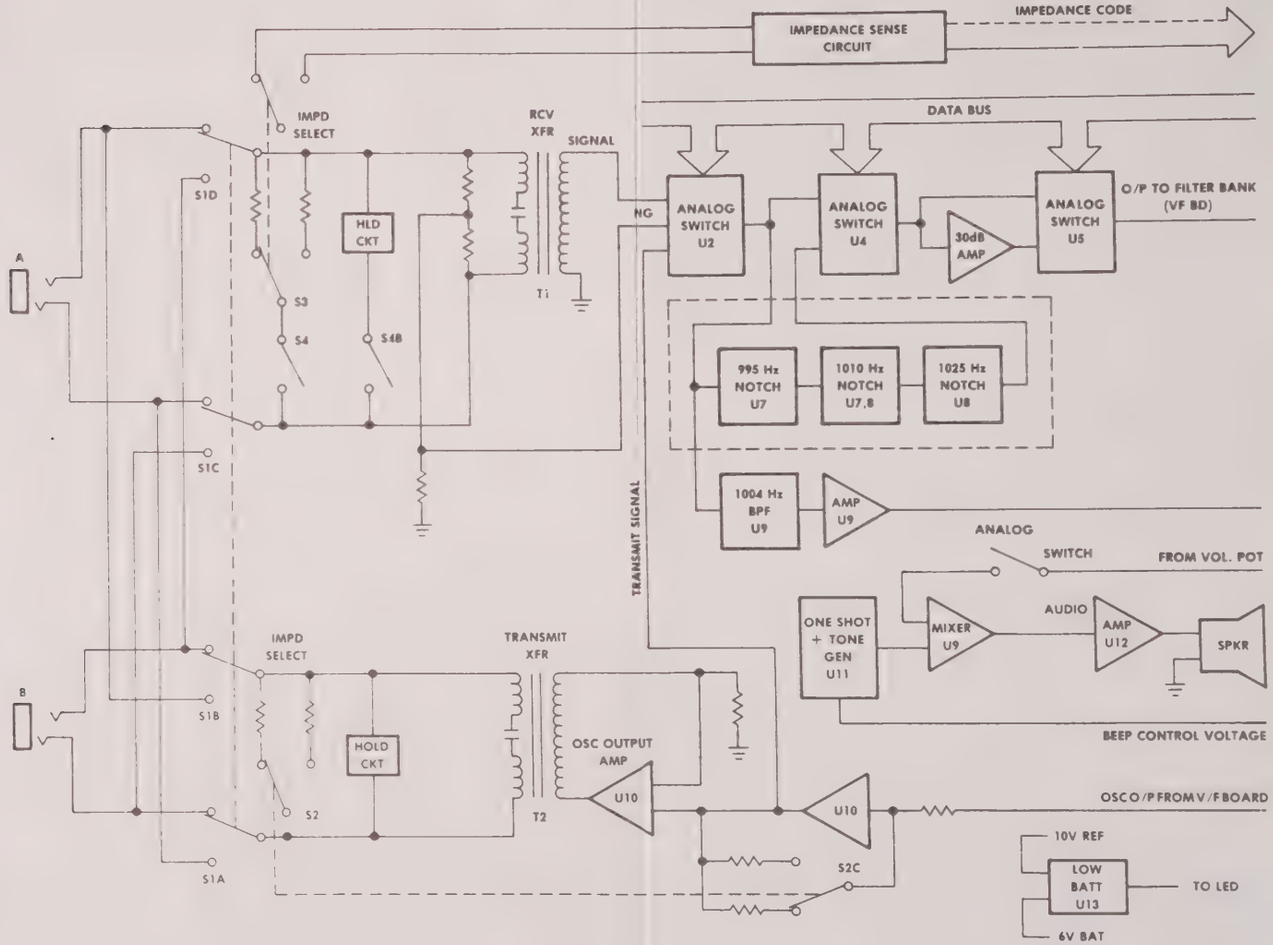


Figure 2.8-2 Block Diagram of the I/O Board Circuits

absence of the holding tone of 1.004 kHz. This holding tone must be used on certain facilities in order to provide a more significant measurement of impulse noise.

2.8.9 Low Input Amplification:

To keep the 1125 signal-to-noise ratio high in the case of a low level input (40 microvolts or 50 dBrn or lower) the 30 db amplifier (U5 and U6 on the I/O board) is switched on and off as needed.

2.8.10 Transmit Signal Output Amplification:

To minimize transformer and line resistance, the switch S2C on the I/O board varies the gain of the transmit output stage (U10, T2) through the transformer so that the voltage at Test Point 20 (TP20) is amplified, if necessary, to ensure a constant output accuracy of +/- 0.1 dB.

2.8.11 Audio Monitoring:

The I/O board holds an audio amplifier (U12) to monitor the signal under test. The beep circuit (U11) provides audio feedback to alert the operator to a keypad entry. To provide a clear indication of keypad entry, the tone signal path to the audio amplifier is disconnected by analog switch U1 whenever the beep-enable signal goes low.

2.8.12 Low Battery Indication:

The 1125 shuts itself down when the battery goes below 5.5 volts. To alert the operator of an impending shutdown, an indicator LED is switched on to indicate a remaining battery useful life of approximately 40 minutes. This is done by a comparator (U13) on the I/O board that compares the battery voltage with the known volt reference on the microprocessor board.

For more information on using the Model 1125, see the Operation Manual.

B. DRAWINGS AND PARTS LIST

2.8.13 Schematic:

For circuit details, refer to the schematic for the I/O board at the end of this section (Figure 2.8-4).

2.8.14 Board Layout:

For the physical location of I/O board components, refer to the Component Location Drawing that follows the parts list in this section (Figure 2.8-5).

2.8.15 I/O (INPUT/OUTPUT) BOARD CALIBRATION

2.8.16 Scope:

This topic gives instructions for setting up and conducting calibration procedures on the Model 1125's I/O circuit board. It includes calibration adjustments for:

- RECEIVER INPUT
- TRANSMITTER OUTPUT
- 1010 HZ NOTCH FILTER

Table 2.8-A lists the test points to be used and the associated calibrations to be make. Figure 2.8-3 shows their locations on the I/O board.

TABLE 2.8-A
I/O BOARD TEST POINTS AND ADJUSTMENTS

TEST POINT (TP)	FUNCTION	ADJUSTMENT (R) OR (C)	FUNCTION
TP 24	Analog ground		
TP 6	Overall I/O board to VF board.	R27	Adjusts overall gain of I/O board.
TP 11	995 Hz notch lower limit output.	R11	Adjusts notch at 995 Hz.
TP 12	1010 Hz notch output.	R18	Adjusts notch at 1010 Hz.
TP 13	1025 Hz notch upper limit output.	R22	Adjusts notch at 1025 Hz.
		R31	Adjusts transmitter output at 600 ohms.

I/O (INPUT/OUTPUT) BOARD CALIBRATION

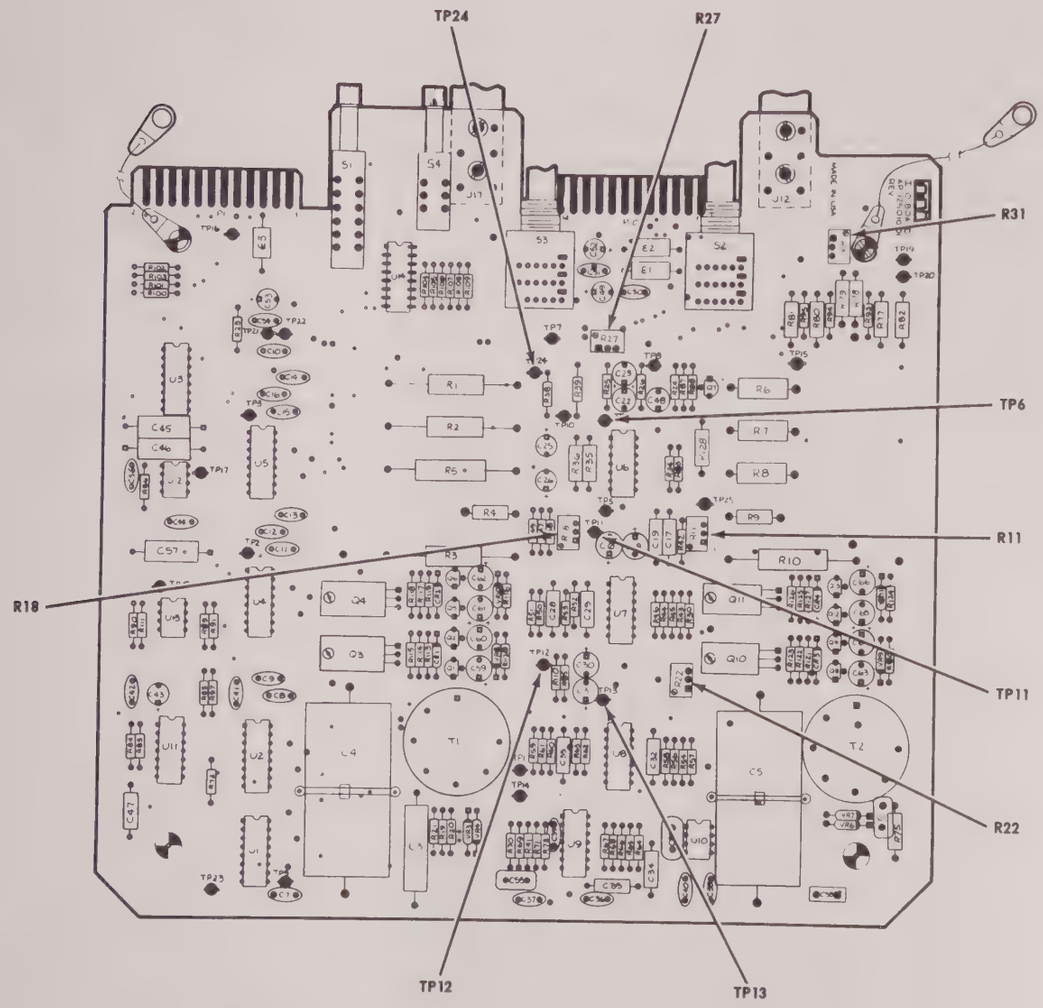


Figure 2.8-3 I/O Board Calibration Locations

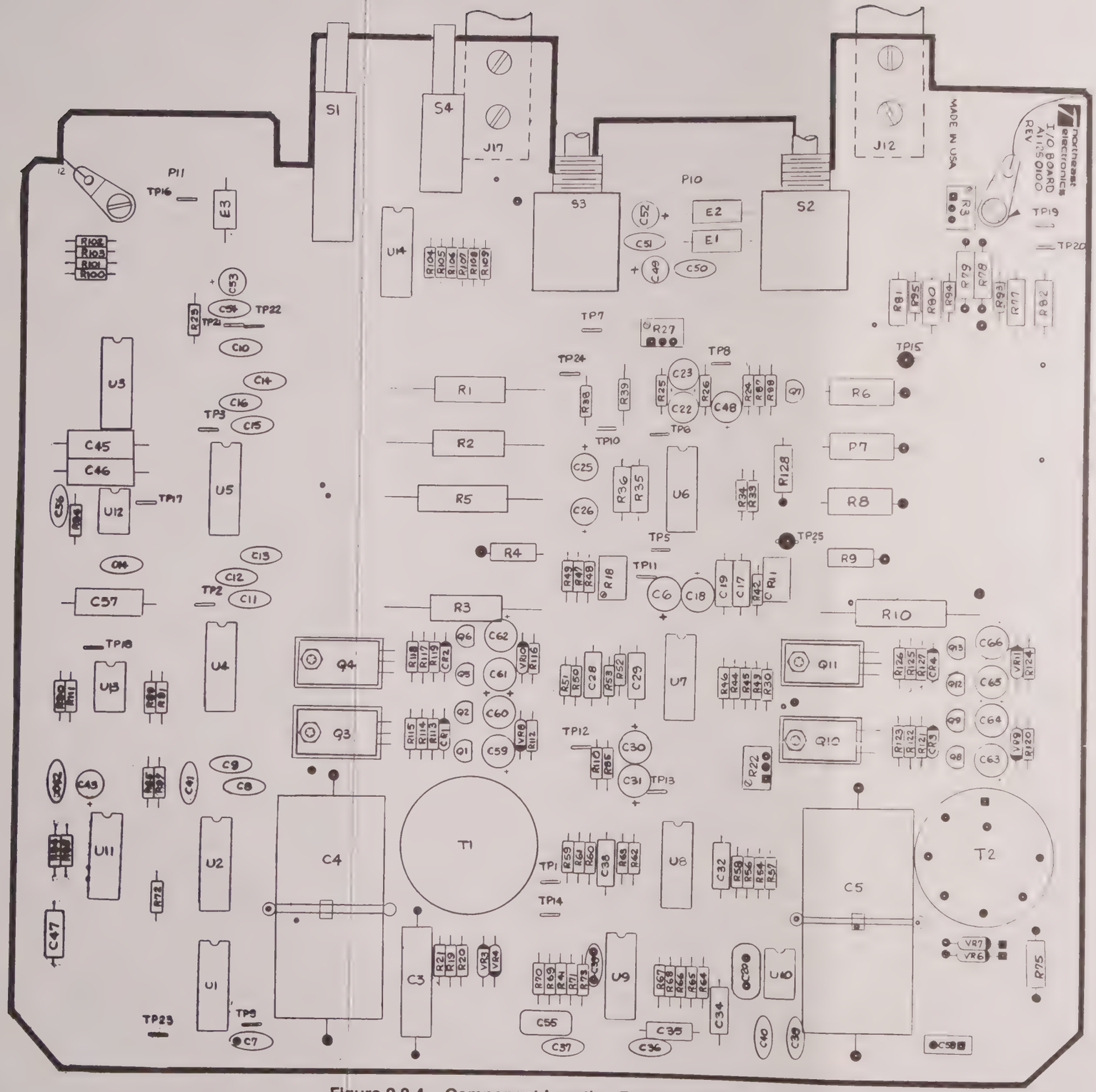
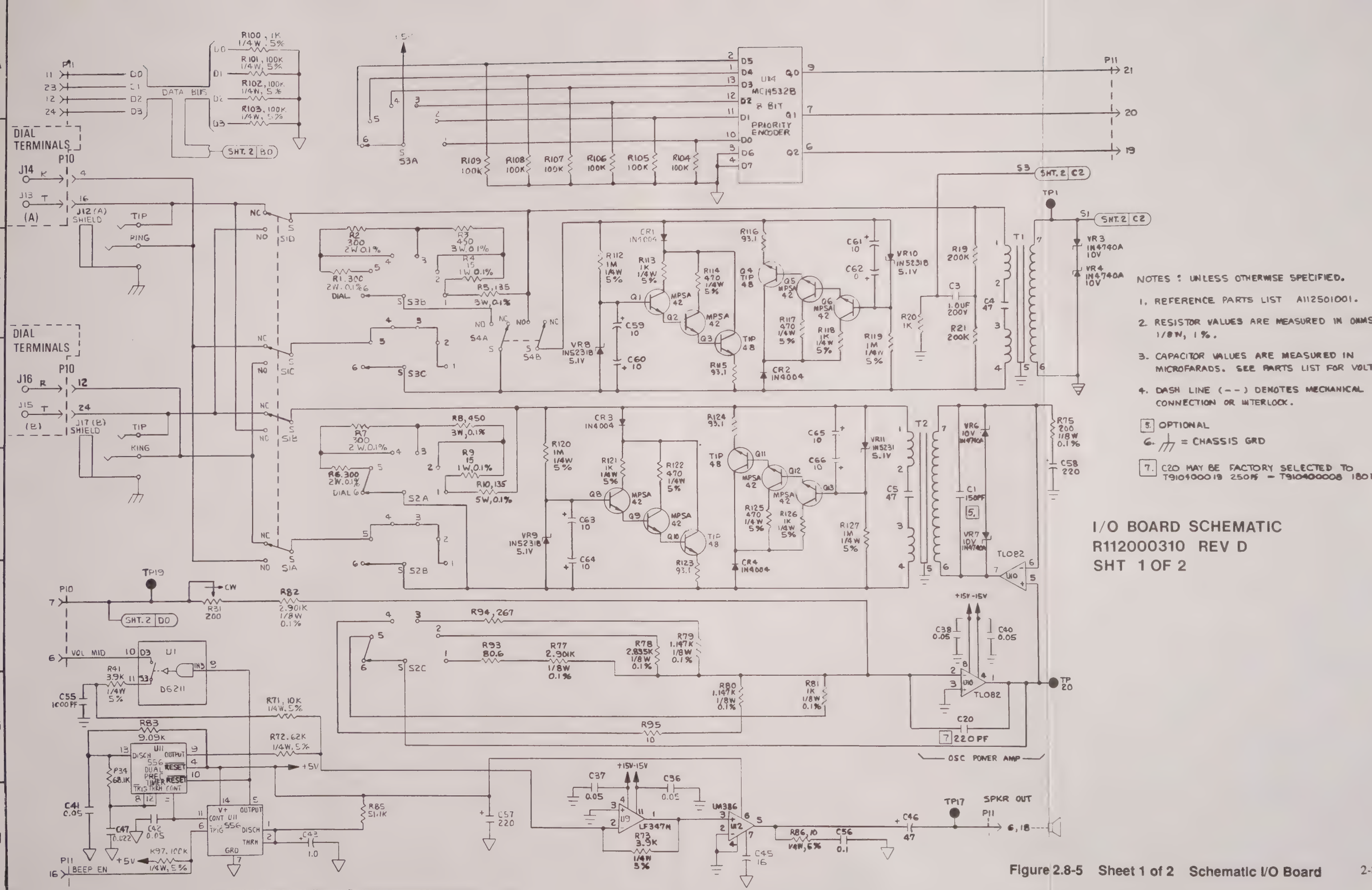


Figure 2.8-4 Component Location Drawing I/O Board



NOTES : UNLESS OTHERWISE SPECIFIED.

1. REFERENCE PARTS LIST A112501001.
2. RESISTOR VALUES ARE MEASURED IN OHMS, 1/8W, 1%.
3. CAPACITOR VALUES ARE MEASURED IN MICROFARADS. SEE PARTS LIST FOR VOLTAGES.
4. DASH LINE (- -) DENOTES MECHANICAL CONNECTION OR INTERLOCK.

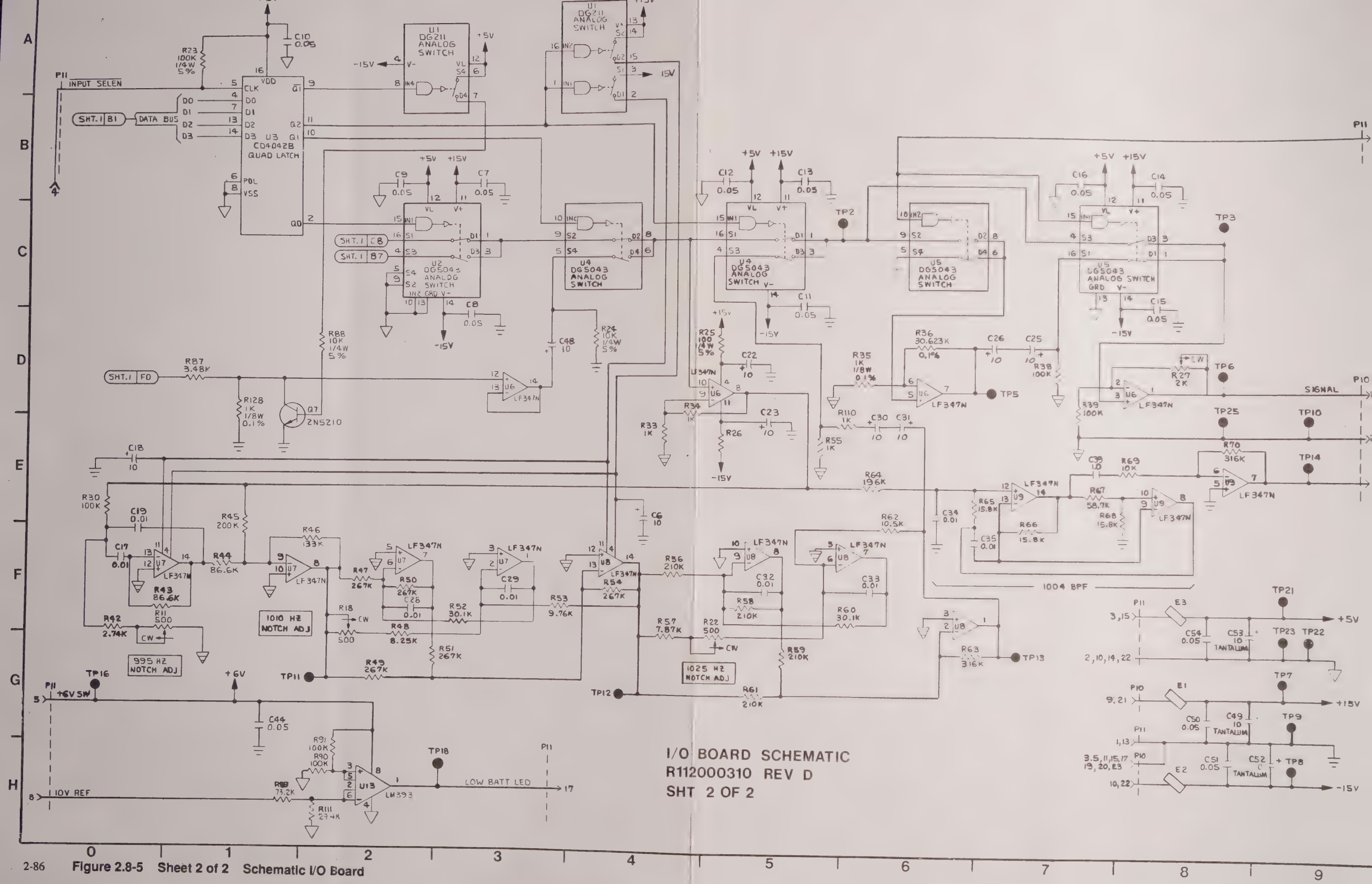
[5.] OPTIONAL

6. ⏚ = CHASSIS GRD

[7.] C20 MAY BE FACTORY SELECTED TO T9104000019 250PF - T9104000008 180PF.

I/O BOARD SCHEMATIC
R112000310 REV D
SHT 1 OF 2

Figure 2.8-5 Sheet 1 of 2 Schematic I/O Board



I/O BOARD SCHEMATIC
R112000310 REV D
SHT 2 OF 2

Figure 2.8-5 Sheet 2 of 2 Schematic I/O Board

A. RECEIVER INPUT CALIBRATION (R27)

2.8.17 Calibration Equipment:

This calibration requires the following equipment:

- Hewlett-Packard 3456A Digital Voltmeter or its equivalent
- Fluke 5200A Programmable AC Calibrator or its equivalent
- Test cable with a dual-banana plug at one end and two alligator clip leads at the other
- Test cable with a dual-banana plug at each end.

2.8.18 Setup:

Before calibrating for receiver input, follow these steps in setting up the equipment.

(1) Insert the dual-banana plug of the first test cable into the right-hand pair of jacks of the digital voltmeter, with the ground or ring prong in the LO jack and the tip prong in the HI jack.

(2) Clip the ground cable lead (black) to TP 24 on the I/O board.

(3) Clip the high-side cable lead (red) to TP6 on the I/O board.

(4) Insert a dual-banana plug of the second cable into the calibrator OUTPUT jacks, with the ground prong in the LO jack and the other prong in the IN jack.

(5) Insert the other dual-banana plug into the binder posts of the Model 1125 A pair jack, with the ground prong in the RING post.

2.8.19 Initial Settings:

This step requires these initial dial or switch settings or program entries:

(1) Press the ACV key of the voltmeter.

(2) Set the calibrator output reading to .774596 volts RMS at 1 kHz.

(3) Set the Model 1125 TRANSMIT and RECEIVE dials both to 600 ohms.

(4) Push the Model 1125 TRANSFER switch to the out position so that the set receives on the A side and transmits on the B side (REC A, TRAN B). Push the BRIDGE/TERM switch in to provide the terminating impedance selected by the RECEIVE switch.

2.8.20 Calibrate Receiver Input:

To calibrate the Model 1125 I/O board for receiver input, follow the instructions give in Chart 2.8-A.

CHART 2.8-A
CALIBRATE RECEIVER INPUT

STEP	ACTION	FUNCTION	INDICATORS
1	ENTER [14] on 1125 keypad.	Sets 1125 display to show receive measurements.	REC LED lights up. 0.0 dBm in left display. 1.000kHz in right display.
2	Adjust resistor R27 on I/O board to get the input shown in the right column.	Calibrates the receive input, if required.	0.78+/-0.002 volts RMS in voltmeter displays after adjustment.

B. 1010 Hz NOTCH FILTER CALIBRATION (R,11,R18,R22)

2.8.21 Calibration Equipment:

This calibration requires the following equipment:

- Hewlett-Packard 3456A Digital Voltmeter or its equivalent
- Fluke 5200A Programmable AC Calibrator or its equivalent
- Hewlett-Packard 5381A Frequency Counter or its equivalent
- Same two test cables as in previous calibration and a cable with a BNC plug at each end.

2.8.22 Setup:

Prior to calibrating the notch filter, make these setup changes:

(1) If not already done, attach one test cable BNC plug to the INPUT jack of the frequency counter and the other BNC plug to the COUNTER OUTPUT jack on the rear panel of the calibrator.

Note: For this calibration procedure, the frequency reading from the frequency counter is used because the frequency level is set too low to get an accurate reading on the Model 1125.

(2) Move the digital voltmeter high-side cable lead to TP11.

2.8.23 Initial Settings:

This calibration requires this initial setting:

Adjust the AC calibrator frequency to get a .995 kHz reading in the Model 1125 right display. Make sure the external frequency counter also reads .995 kHz.

2.8.24 Calibrate Notch Filter:

To calibrate the Model 1125 I/O board notch filter, follow the instructions given in Chart 2.8-B.

CHART 2.8-B
CALIBRATE NOTCH FILTER

STEP	ACTION	FUNCTION	INDICATORS
1	ENTER [24] on the 1125	Selects 15 kHz flat filter	15 kHz LED lights. 90 dBrn in 1125 left display.
2	ENTER [27]	Selects 1010 Hz notch filter	NOTCH LED lights.
3	Adjust R11 on I/Oboard to get min. volt.	Calibrates notch filter at 995 Hz.	Must be below 0.01 volts RMS on voltmeter display
4	Move voltmeter high side cable to TP 12.	Sets up for R18 adjustment.	
5	Change calibrator frequency to 1.010 kHz.	Outputs correct frequency to the frequency counter	1.010 kHz on the frequency counter display.
6	Adjust R18 on I/O board to get minimum voltage.	Calibrates notch at 1010 Hz. display.	Must be below 0.002 volts RMS on voltmeter
7	Move voltmeter high side cable to TP 13.	Sets up for R22 adjustment.	
8	Change calibrator frequency to 1.025 kHz.	Output correct frequency to the counter	1.025 kHz on the frequency counter display.
9	Adjust R22 on I/O board to get minimum voltage.	Calibrates notch at 1.025 kHz.	Must be below 0.002 volts on voltmeter display.

C. TRANSMITTER OUTPUT CALIBRATION (R31)

2.8.25 Calibration Equipment:

This calibration requires the following equipment:

- Hewlett-Packard 3456A Digital Voltmeter or its equivalent
- Fluke 5200A Programmable AC Calibrator or its equivalent
- Test cables already connected to the voltmeter and the calibrator.

2.8.26 Setup:

Make these setup changes for this calibration.

(1) Do not use the frequency counter again while calibrating the I/O board.

(2) Move the dual-banana plug from the Model 1125 A pair binding posts to the B pair binding posts.

(3) Remove the cable dual-banana plug from the digital voltmeter HI/LO jacks and replace it with a 600-ohm dual-banana prong resistor (5 watts,.1% tolerance) with the ground prong of the resistor in the LO jack.

(4) Insert the banana plug of the voltmeter cable into the jacks of the 600-ohm resistor.

(5) Keep the other leads of the voltmeter cable clipped to the same test points (TP24 and TP13).

2.8.27 Initial Settings:

There is no change in equipment settings.

2.8.28 Calibrate Transmitter Output:

To calibrate the Model 1125 I/O board transmitter output, follow the instructions given in Chart 2.8-C.

2.8.29 The I/O board is calibrated. The VF board can now be calibrated as instructed in Section 2.7

CHART 2.8-C
CALIBRATE TRANSMITTER OUTPUT

STEP	ACTION	FUNCTION	INDICATORS
1	ENTER [13] on 1125 keypad.	Sets 1125 display to show transmit measurements.	TRAN LED lights up. 1125 displays 0.0 dBm at 1.004 kHz.
2	ENTER [20}.	Selects level dBm function.	LEVEL LED lights.
3	Adjust R31 on I/O board to get readings shown at right.	Calibrates transmitter output at 600 ohms.	0.7745 volts RMS reading on the voltmeter display. 1125 displays should read 0.0 dBm at 1.004 kHz.

2.9 POWER SUPPLY

2.9.1 Scope:

This section explains the parts and functions of the Model 1125 power supply assembly, summarizes its operation, describes its circuitry, and give directions for testing it. For reference purposes, it includes block diagrams, a wiring diagram, a component layout drawing, and a schematic of the power supply circuit board.

A. POWER SUPPLY ASSEMBLY AND FUNCTIONS

2.9.2 Physical Description and Location:

The power supply assembly consists of the power supply circuit board and other power components attached to the 1125 rear panel. (See Figures 2.9-1 and 2.9-2.) The power supply circuit board is fastened to the inside of the rear panel using a raised frame to allow for air circulation. Also attached to the inside of the rear panel are the power transformer and ten power transistors. The battery is clamped to a divider separating the power supply assembly from the other circuit boards. On the outside of the rear panel are attached the fuse holder and a ground binding post. The AC power cord comes through the rear panel to the fuse holder and power transformer. Cable subassemblies connect the power supply circuit board to the transformer and battery, and to the power switch and other connections on the 1125 display circuit board or front panel. Two clips on the outside of the rear panel each holds an extra fuse. (For instructions for the disassembly and assembly of these parts of the Model 1125, see Section 2.2.)

> **Note:** The power transistors are mounted on the inside rear panel, which helps dissipate the heat they generate.

2.9.3 Functions:

The power supply assembly, mainly the power supply circuit board, is used chiefly to:

- modify an external AC current and output required DC voltages
- charge the battery when so directed
- shut off the battery under certain conditions
- regulate voltages for constant output

2.9.4 See Figure 2.9-3 for a block diagram of these functions.

B. CIRCUITRY

2.9.5 A description of the power supply circuitry follows. (Alphanumeric codes, such as U1, identify certain components in the Component Location and Schematic drawings, Figures 2.9-11 and 2.9-12).

2.9.6 IAC Power Transformer Circuitry:

The 115 VAC +/- 10% external AC line voltage is connected to the power transformer (T2) through a protection fuse. The power is stepped down by the transformer to approximate a loaded 8.6 VAC +/- 10% and routed to a half-wave rectifier (CR1) and a filter circuit (C1, C2) to produce an initial unregulated direct current for the other power supply assembly circuits (Figure 2.9-4).

2.9.7 Battery Charging Circuitry:

The battery charging circuitry (Figure 2.9-5) maintains the Model 1125 as a portable battery-operated instrument. A programmable zener (U1) detects low voltage in the battery (6.4 volts or lower) and turns on the transistor (Q2) that drives the passing power transistor (Q1) for the charging path from the power source. The charging current of 1.0 ADC is automatically shut off when the battery voltage increases to 7.6 volts. The battery-charging circuit functions whenever the 1125 is plugged into an AC line and the front panel ON/OFF switch is in the OFF position. (When the 1125 is switched to ON, a small trickle charge is present.)

> **Note:** An indicator light near the top edge of the power supply circuit board is turned on while the battery is being charged. The light is visible only when the 1125 chassis top panel has been removed.

2.9.8 Battery Shut-off Circuitry:

This shut-off circuitry (Figure 2.9-6) operates under any one of three conditions:

- Shuts down the battery output when it senses that the AC voltage is active. As soon as it is active, a zener (CR5), two resistors (R8,R23), and a transistor (Q3) work together to disable the transistors

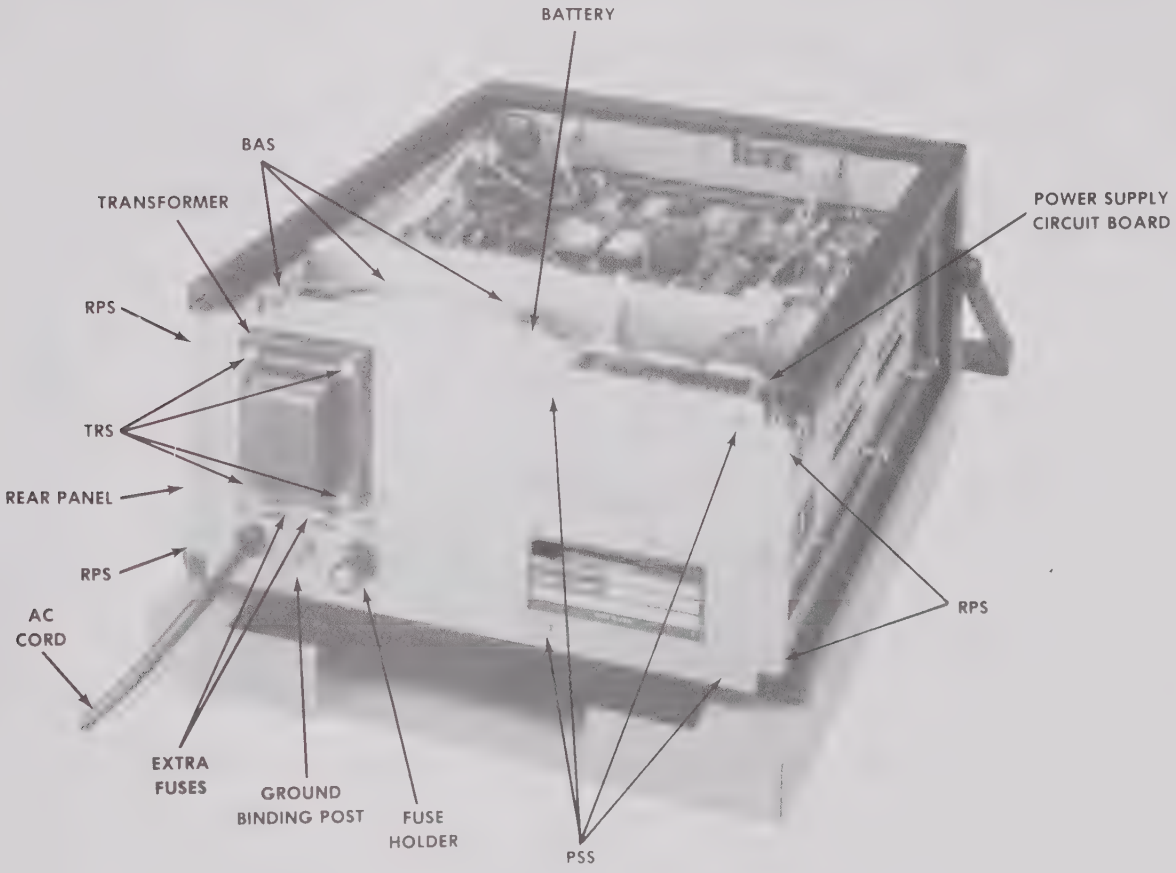


Figure 2.9-1 Power Supply Assembly—Outside Rear View

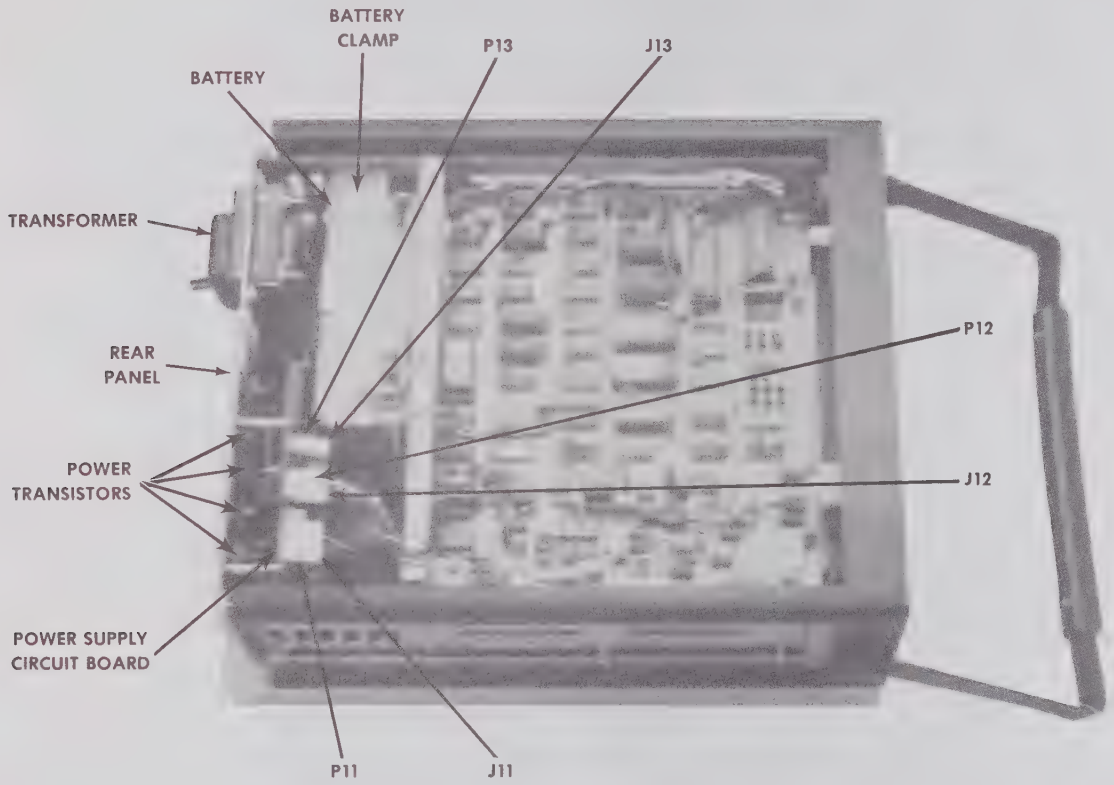


Figure 2.9-2 Power Supply Assembly—Inside Rear View

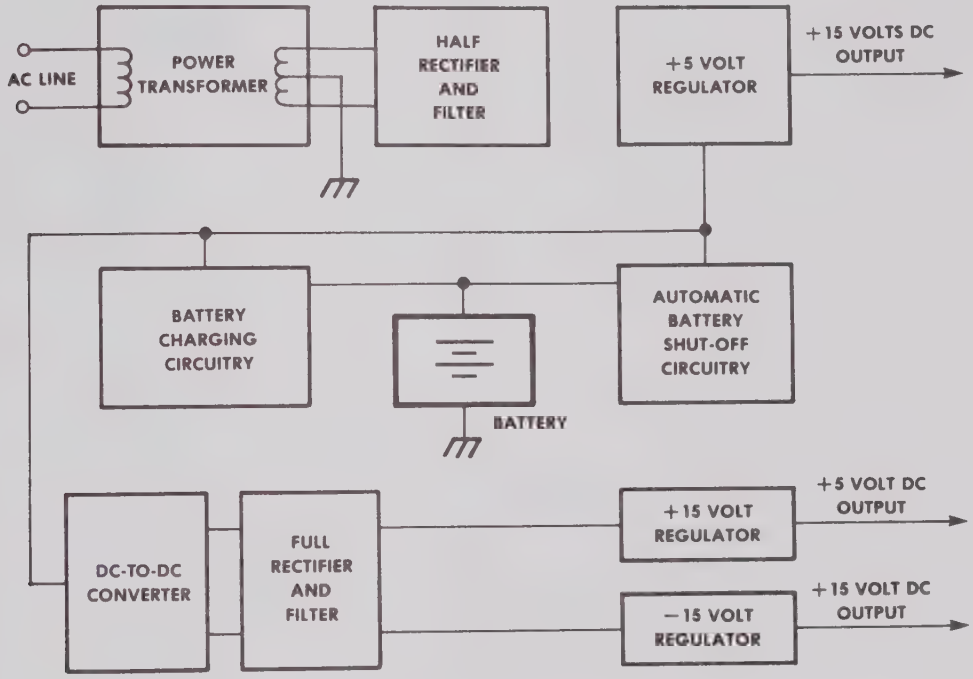


Figure 2.9-3 Block Diagram of Power Supply Board Functions

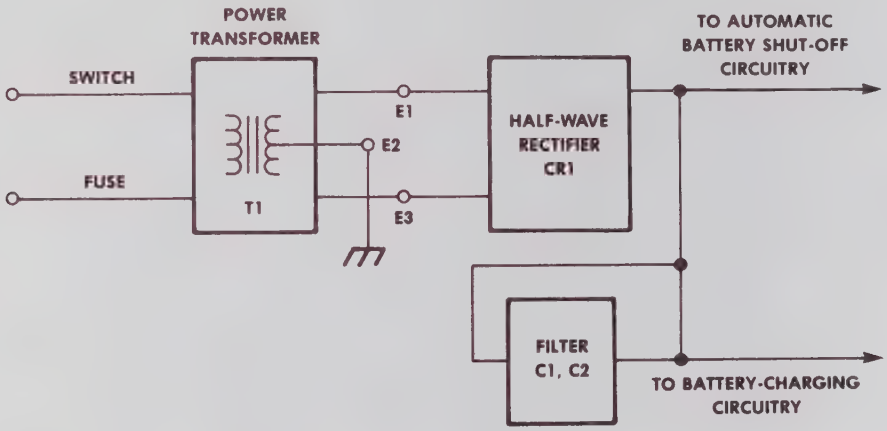


Figure 2.9-4 Block Diagram of the AC Power Circuitry

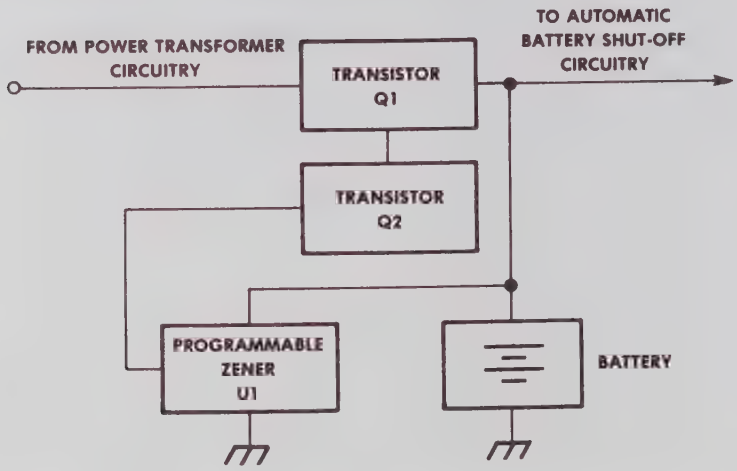


Figure 2.9-5 Block Diagram of the Battery Charging Circuitry

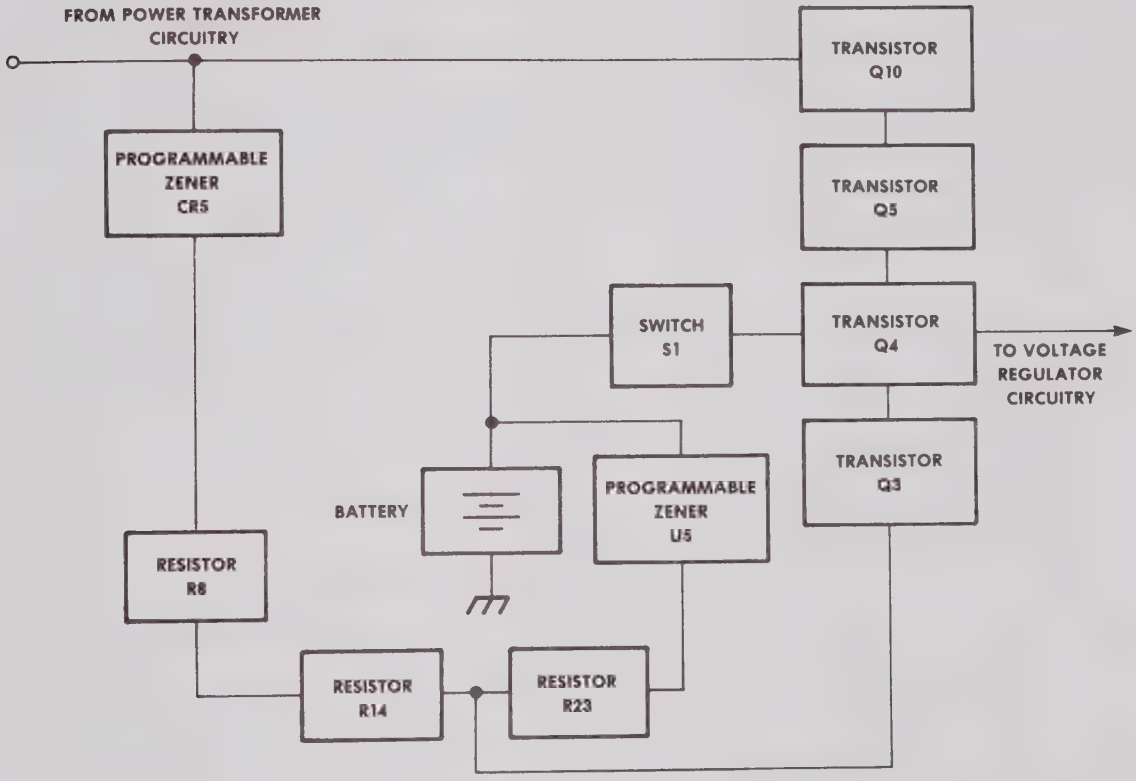


Figure 2.9-6 Block Diagram of the Battery Shut-off Circuitry

(Q4, Q5, Q10) activate battery power.

- Ensures the 1125 is shut off when the battery voltage reaches 5.5 volts or lower. This is necessary because the +5 volts regulator and the DC to DC converter require a minimum input voltage to operate. A battery status LED lamp (DS1) on the front panel warns the user of a low battery condition. When the battery condition drops too low, a programmable zener (U5), two resistors (R14, R23), and a transistor (Q3) work together to disable the battery activating transistors (Q4, Q5, Q10).

- Provides a conduction path for the DC battery supply as long as the battery voltage is 5.6 volts or higher and AC power is not on. Under these conditions, zener U5 stays at low voltage causing transistor Q3 to turn off. This in turn causes the battery-activating transistors (Q4, Q5, Q10) to stay on or turn on.

Note: The mechanical ON/OFF switch (S1) in the schematic drawing is located on the Model 1125 front panel and is controlled by the user.

2.9.9 Voltage Regulator Circuitry:

Separate regulator circuits are provided to produce +5 volt and a +/-15 volt supplies (Figure 2.9-7).

- The +5 volt supply is series regulated by a passing power transistor (Q6) that is controlled by a programmable zener (U2) and an adjustable resistor (R12).

- The DC power for the +/- 15 volt supply lines is first stepped up with a DC to DC converter circuit. The heart of this circuit is a transformer (T1) used for both a base driving source to transistors and a collector power source for regulation. The current is then passed on first to a full-wave bridge rectifier (CR7-CR10) and then to a capacitor filtering circuit (C10, C12). Finally, this unregulated +/- 18 voltage passes through two regulators (U3, U4) to output a constant + 15 volts DC +/- 0.7 and -15 volts DC +/- 0.7.

C. TESTING THE POWER SUPPLY OUTPUTS

2.9.10 Objective:

Follow the instructions below for testing the Model 1125 power supply outputs. The test results should conform to the output specifications in Table 2.9-A.

2.9.11 Power Supply Wiring:

The power supply circuit board receives or distributes power using several sets of wires and connectors. This internal wiring is visible when the top panel of the Model 1125 is removed. To identify wires and connectors, refer to the wiring diagram (Figure 2.9-10).

2.9.12 Power Supply Specifications:

Table 2.9-A summarizes the power supply specifications.

2.9.13 Test Equipment:

Table 2.9-B lists the equipment needed.

Note: If it is necessary to use a different make or model digital multimeter, the location and labels of cable jacks may differ from those described here.

2.9.14 Precautions:

The Model 1125 contains static-sensitive devices that can be damaged during handling. To avoid accidental damage, observe the following precautions:

- Wear a wrist ground-strap

- Stand on a static-suppressive floor mat, such as those used in digital central offices.

WARNING: Turn the Model 1125 power switch off and disconnect the power cord from the 115 VAC power receptacle before starting any disassembly work.

```
*******************************************************
*                                                     *
*           - DANGEROUS VOLTAGE PRESENT -             *
*                                                     *
* - Take Necessary Precautions To Preclude Injury - *
*                                                     *
*                                                     *
*******************************************************
```

2.9.15 Disassembly:

Using the disassembly instructions in Section 2.2, remove the top panel of the Model 1125 chassis. It will not be necessary to remove the side or rear panels or the power supply circuit board.

2.9.16 Initial Equipment Setup:

With the Model 1125 power cord still disconnected, do the following equipment setup in preparation for conducting the tests.

(1) Insert the black banana plug of the test cable in the GROUND or LOW jack of the digital multimeter.

(2) Insert the red banana plug in the INPUT jack of the digital multimeter.

(3) Clamp the alligator clip lead to a good ground on the Model 1125 chassis, such as a bolt holding the transformer case.

(4) Turn ON the power switch of the digital multimeter.

2.9.17 Output Tests With Load:

To initially test power supply output, follow these steps:

(1) Reconnect the Model 1125 AC power cord to the power receptacle and pull ON the Model 1125 front-panel power switch.

(2) Locate the 5-pin wire connector (J11) at the upper-left edge of the power supply circuit board. The three output tests are all conducted with a test probe at this 5-pin connector.

(3) Start doing tests "with load," where J11 joins to the corresponding fixed connector (P11). The 1125 system will draw current from the power supply.

(4) Move the probe from wire to wire as shown in the left column of Table 2.9-C. Each time, insert the probe into the wire opening so that the point passes the insulation and touches the bare wire (Figure 2.9-8).

(5) Check the digital multimeter display against the table's right-hand column to see if the 1125 voltage output conforms to the specification.

(6) Make a note of any output reading that does not conform to the specification.

2.9.18 No-Load Test Followup:

If any of the three test results were below the specification and tolerance given in the table, perform this procedure:

Disconnect J11 from P11. Pull this wire connector straight out to avoid bending the P11 pins it encloses.

TABLE 2.9-A
POWER SUPPLY SPECIFICATIONS

DIRECTION		SPECIFICATION
INPUTS:	Power Source Battery (fully charged)	115 VAC at 60 Hz 6 volts, 10 AH (Amps per Hour)
OUTPUTS:	Power Supply Board	+15 volts +/-0.5 -15 volts +/-0.5 + 5 volts +/-0.5

TABLE 2.9-B
TEST EQUIPMENT NEEDED

EQUIPMENT	RECOMMENDED MAKE
Digital Multimeter (five digits) Test cable with two single banana plugs at one end and an alligator clip and test probe at the other.	Dana 4700A or its equivalent

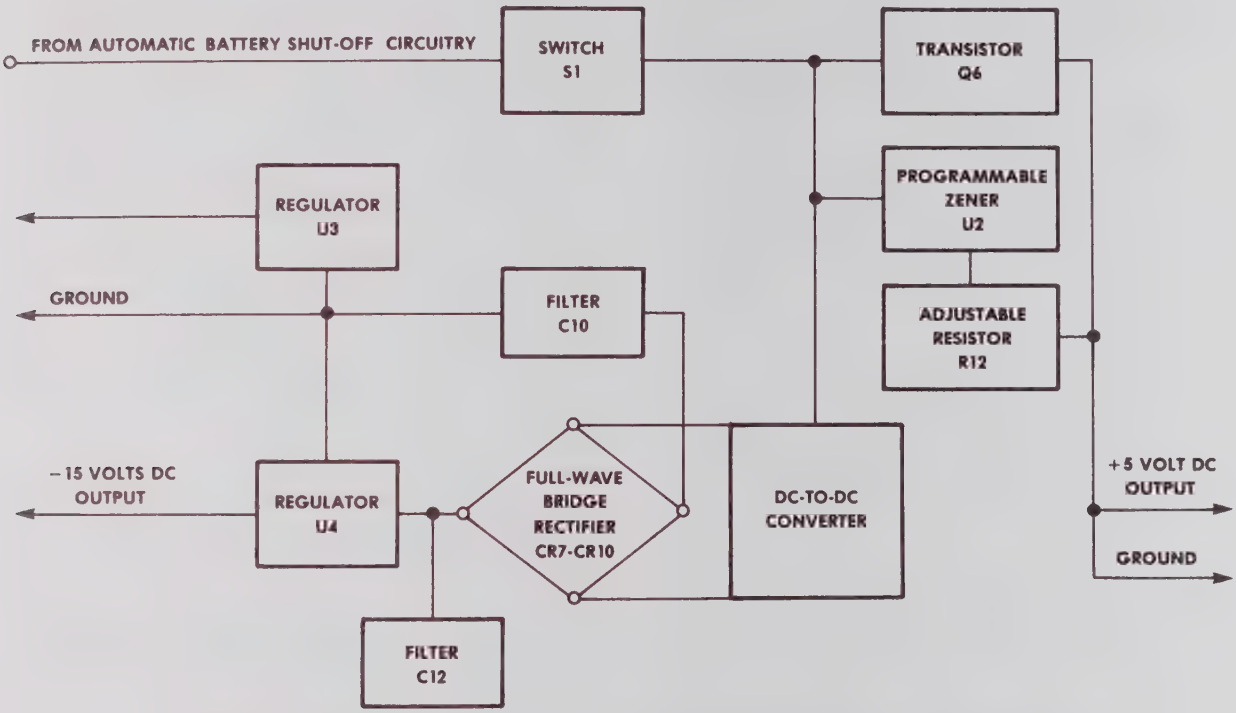


Figure 2.9-7 Block Diagram of the Voltage Regulator Circuitry

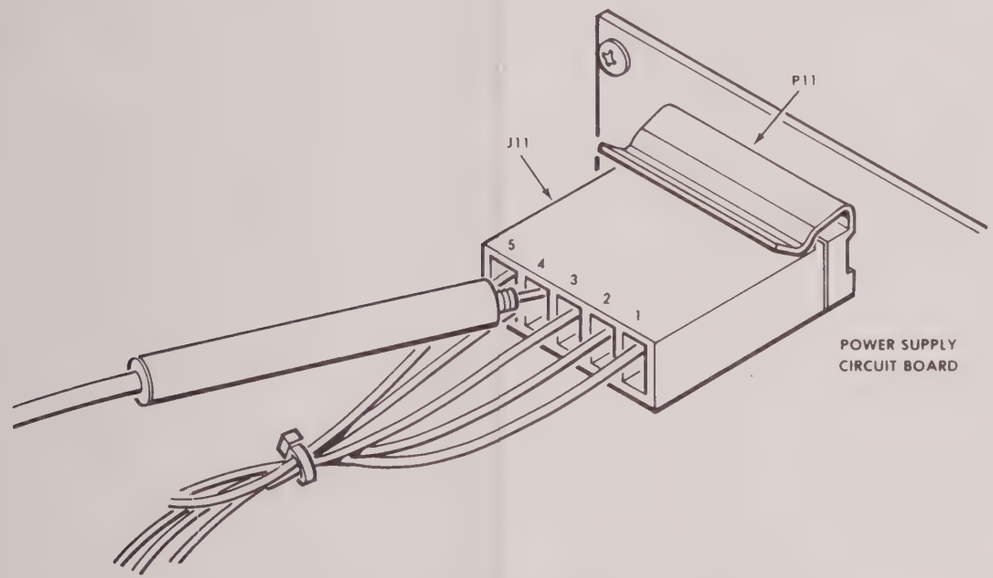


Figure 2.9-8 Connector J11 Test Points (with Load)

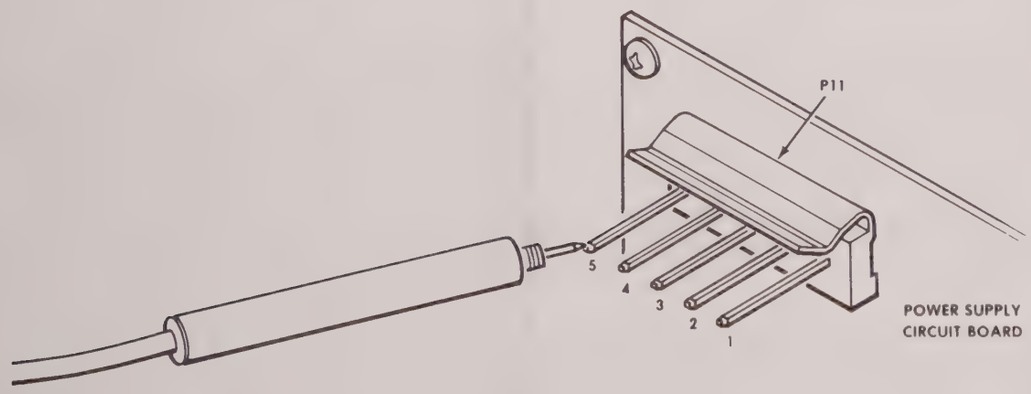


Figure 2.9-9 Connector J11 Test Points (No Load)

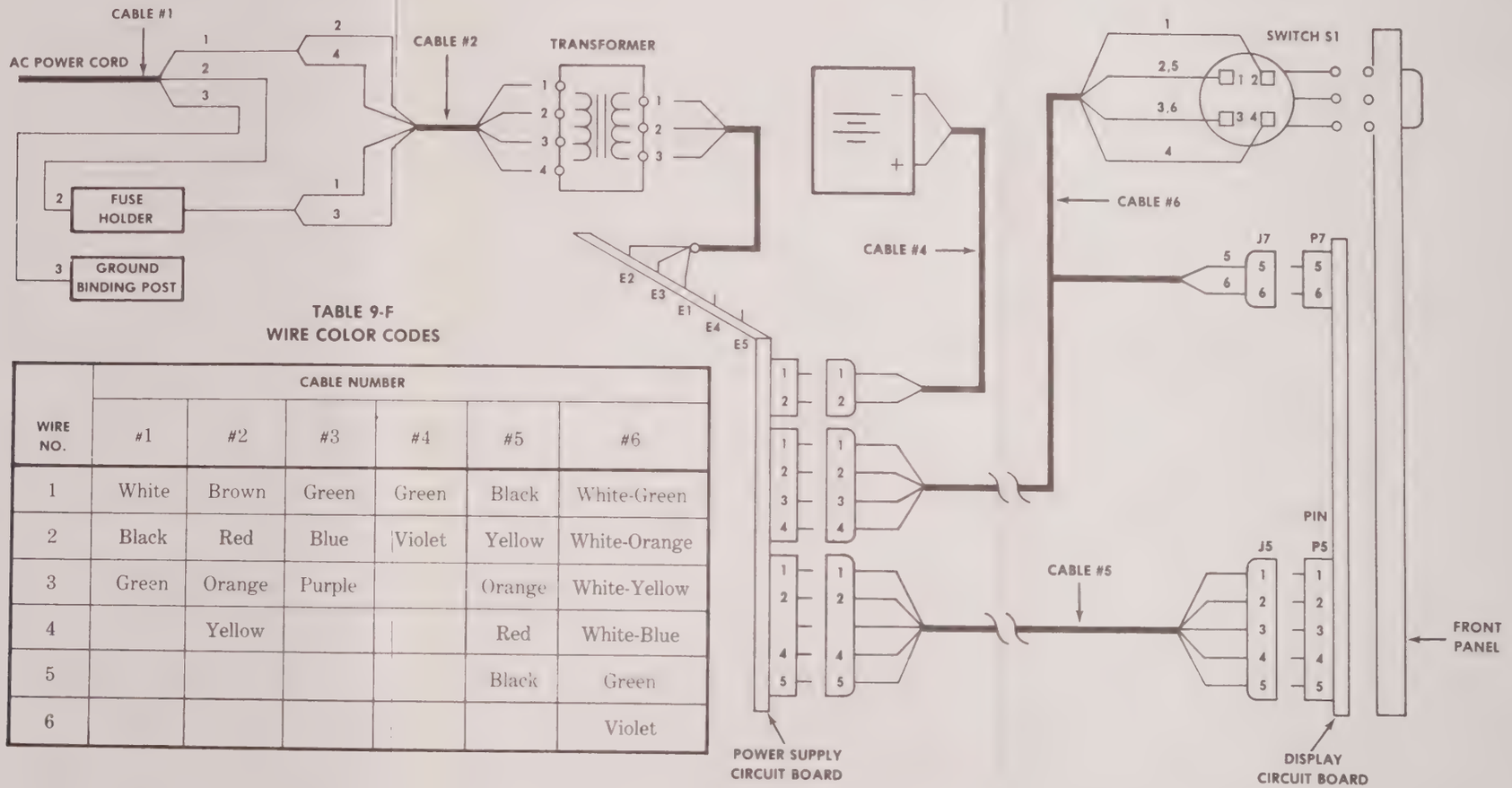


TABLE 9-F
WIRE COLOR CODES

WIRE NO.	CABLE NUMBER #1	#2	#3	#4	#5	#6
1	White	Brown	Green	Green	Black	White-Green
2	Black	Red	Blue	Violet	Yellow	White-Orange
3	Green	Orange	Purple		Orange	White-Yellow
4		Yellow			Red	White-Blue
5					Black	Green
6						Violet

Figure 2.9-10 Wiring Diagram

TABLE 2.9-C
WITH-LOAD OUTPUT TEST SPECIFICATIONS

POWER SUPPLY BOARD TEST POINT	DC VOLTAGE READING (Multimeter Display)
J11 Wire #4 (Red)	+ 15 volts +/-0.5
J11 Wire #3 (Orange)	- 15 volts +/-0.5
J11 Wire #2 (Yellow)	+ 5 volts +/-0.5

(2) Repeat the three tests above, applying the probe directly to the corresponding pin of P11, first pin #4, then pin #3, and finally pin #2 (Figure 2.9-9).

(3) Make a note of any multimeter reading that does not conform to the specification.

2.9.19 Repeat Test With Load:

(1) Reconnect J11 to P11, being careful not to bend the pins.

(2) Run the three output test once again, but now "with-load."

(3) For each test, note any variance in the multimeter reading from the reading for the same output in the "no-load" state.

(4) See the following paragraph for how to evaluate test results.

2.9.20 Test Results:

Refer to Table 2.9-D to evaluate the results of these power supply tests. If the evaluation indicates that the power supply is malfunctioning, then call Northeast Customer Service to describe the test failure and get assistance.

Note: Any time the Model 1125 power supply has been repaired or replaced, retest the voltage outputs, using the above procedure. If the multimeter reading is below tolerance for any output under the "with-load" condition, this is an indicator that some other circuit or component of the 1125 set is impaired.

2.9.21 Reassembly:

To reassemble the Model 1125 after disconnecting the multimeter from the set, follow the instructions in Section 2.2.

D. DRAWINGS AND PARTS LIST

2.9.22 Wiring Diagram:

For wiring lay out and connections, see the diagram that follows the parts list in this section (Figure 2.9-10).

2.9.23 Board Layout:

For the physical location of power supply board components, refer to the Component Location Drawing that follows this section. (Figure 2.9-11)

2.9.24 Schematic:

For circuit details, refer to the schematic for the power supply board at the end of this section (Figure 2.9-12).

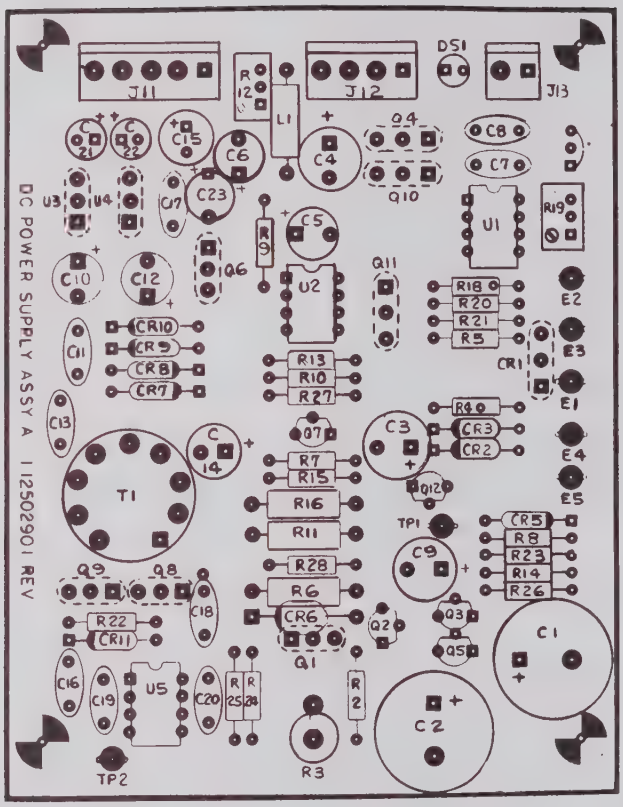


Figure 2.9-11 Component Location Power Supply Board

NOTES: UNLESS OTHERWISE SPECIFIED

1. REFERENCE PARTS LIST A112502901.
2. RESISTOR VALUES ARE MEASURED IN OHMS. 1/8W, 1%
3. CAPACITOR VALUES ARE MEASURED IN MICROFARADS. SEE PARTS LIST FOR VOLTAGES.
4. COMPONENTS WITHIN DASH LINES (- - -) ARE MOUNTED ON BACKPLATE

DC POWER SUPPLY SCHEMATIC
R112500307 REV C
SHT 1 OF 1

Figure 2.9-12 Schematic DC Power Supply

TABLE 2.9-D
EVALUATING TEST RESULTS

TEST CONDITION	DMM READING	EVALUATION/ACTION
Output - WITH LOAD +15 -15 +5 VDC	Within tolerances	Power supply is okay.
	Below or above tolerances	Repeat the three tests but under "no-load" (above).
Output - NO LOAD +15 -15 +5 VDC	Below 4.0 VDC	Power supply needs repair or replacement.
	Within tolerances	Repeat the "with load" tests in order to check your first results. (See below)
Output - WITH LOAD REPEATED AFTER NO-LOAD	Within tolerances	Power supply is okay
	Below no load reading	Power supply needs repair or replacement.
	Above no load reading	1125 system impaired in some other part.

SECTION 3
PARTS LIST

3.1 This section contains parts lists for electronic components found in this unit. The assembly diagrams and parts location diagrams found in other sections of this manual show where individual parts are used within the unit.

Part No.	Description	Qty Asem.	Ref Des	MFG/Vendor Part#	MFG Name		Source Price
A112500903	FAMILY TREE						
A001000501	ASSY, FRAME & HNDL, WIDE & LNG						
810000008	WASHER,RAISED LIP,#8	2		RHW-102	CAPLUGS	(P)	.40
T001000701	HANDLE,STEEL BAR	1					51.98
T001000801	BAR,PLASTIC,TOP	1					34.27
T001000901	BAR,PLASTIC,BOTTOM	1					57.46
T001001001	BUMPER,	1					6.30
T1000110901	BUMPER,CORNER	4		KP1569	KIRKHILL RUBBER	(P)	2.45
T1000132001	CASTING,FRONT	1					75.60
T1000132201	COVER,BOTTOM	1					59.99
T1000132301	COVER,TOP	1					40.97
T1000132401	COVER,SIDE	2					45.69
T1000132501	SIDE RAIL,	4					33.44
T810050610	SCR,FH,Z/N,6-32X.625	2					.24
T810051020	SCR,FH,Z/N,SS,1M,10-32X1.250	4					.56
T810120808	SCR,PH,ZN/NK,8-32X.5,SS,8MM	2					.24
T810121008	SCR,PANHD,Z/N,SS10.3,10-32X.5	4		10-32X 1/2	ACCURATE FASTENERS	(P)	.32
T814601000	NUT,KEP,Z/NKL,#10-32,10.12	4		10-32 ZN/NKL KEP NUT	ACCURATE FASTENERS	(P)	.32
T814620605	NUT,KEP,SS,6.20,6-32X.3125	2		6-32 SST KEP NUT	ACCURATE FASTENERS	(P)	.24
T814804981	WASHER,FLAT,Z/N,8.10,#8X.03125	2		#8 ZN/NKL FLAT	ACCURATE FASTENERS	(P)	.08
T814887512	WASHER,NEO,.062,.265IDX.7450D	2			SEASTROM MFG. CO.		3.03
T816784904	SPACER,SST,#8,.250CL,.25RD	2			ANATOM		1.68
T823000006	ADHESIVE,LOCTITE,SCREW LCH,P.9	0		79-31	LOCTITE	(P)	54.72
T865000006	SCR,SNAP CAP,BLACK,#10,#12	2		RH-10	CAPLUGS	(P)	.40
T972500019	BUMPER,RUBBER FEET,0.6HIX0.9	4		9121	RUBBER CRAFT	(P)	2.40
A112500011	ASSY, PROCESSOR BD, W/FIRMWARE						
A112500601	ASSY,PCB,PROCESSOR	1					25.00
A112500800	FIRMWARE,WO/PAR,1125	1					86.03
A112500101	ASSY, O/A, TTS, IMP. NOISE, DC		A112500101				
A001000501	ASSY,FRAME & HNDL,WIDE & LNG	1	A001000501				302.18
A112501201	ASSY,CHASSIS,INTERNAL,DC	1					301.00
T1000108503	CASTING,REAR	1	A112500101 MP1				58.43
T1000112601	LABEL,PATENT	1	A112500101 MP2				1.44
T1000132101	LABEL,P/AR OPTION	1	A112500101 MP3				7.82
T112504501	LABEL,OPERATION OVERVIEW	1	A112500101 MP4				31.44
T811120605	SCR,PANHD,SS,6-32X..312,SS 6.2	16	A112500101 MP5	MS5233-27	ACCURATE FASTENERS	(P)	.24
T811120606	SCR,PANHD,SS,6-32X.375,SS 6.3	4	A112500101 MP6	MS35233-28	ACCURATE FASTENERS	(P)	.40
T814751000	NUT,ESSNA LK,Z/NKL,10-13#10-32	2	A112500101 MP7	21NN02	ACCURATE FASTENERS	(P)	.40
T814805081	WASHER,FLAT,Z/N,10.15,#10X.031	2	A112500101 MP8	AN960-10	ACCURATE FASTENERS	(P)	.48
T853000008	SCR,TIE CLP,3.9LX.1WX.6DX18#	3	A112500101 MP10	PLC1M-S4-CP	PANDUIT	(P)	.64
				WITS-18MR	RICHCO	(2)	.64
T970300061	CABLE,CSA/UL,300V,22AWG,6COND	1	A112500101 MP11	882206	DEARBORN	(P)	3.99
T970400064	HOUSING RECP,5POS,MWX62,WRAMP	2	A112500101 J5,J11	09-50-3051	MOLEX	(P)	1.12
T972500020	BUMPER,RUBBER FEET,0.5HIX0.6	4	A112500101 MP12	9117	RUBBER CRAFT	(P)	.81
A112500401	ASSY, PCB, DISPLAY						
564500805	LED,RED,2.2V,T1	44	FIG 2.5-4 DS1-DS27,DS29-DS45	HLMP-1301	HEWL-PACK	(P)	2.11
654003601	LOCK,FRICTION,2 CKT	1	FIG 2.5-4 P7	09-65-1021/KK156 SER	MOLEX	(P)	.88
827200050	SPACER,NYLON,.315"H	44	FIG 2.5-4 MP1	908-315	BIVAR INC	(P)	.16
R112500304	SCHEMATIC,DISPLAY BOARD	0	REF				.00
R112500404	PERF SPEC,DISPLAY BD	0	REF				.00
T112500501	PCB,DISPLAY	1	FIG 2.5-4 MP2				76.57
T862251418	TET SEAL 7/8IDX11/8 OD RUB BLK	1	FIG 2.5-4 MP3	TS-212	GOSHEN RUBBER	(P)	.72
T930700270	RES,27R,.25W,5%, CF	1	FIG 2.5-4 R1	CB2705	ALLEN BRADLEY	(P)	.40

Part No.	Description	Qty Asem.	Ref Deg	MFG/Vendor Part#	MFG Name		Source Price
T930700271	RES,270R,.25W,5%, CF	1	FIG 2.5-4 R2	R25J270R	ROHM	(P)	.40
T940300033	LED,RED,SNGL,7SEG,.50HI,RHDP	8	FIG 2.5-4 DS46-53	HD1105R	SIEMENS	(P)	9.34
T970200076	BUTTON,HO,216XWO.386XDO.25PB	16	FIG 2.5-4 MP4	FSC21275 BLACK	ITT SCHAD	(P)	2.03
T970400019	CONNECTOR,DUAL,12POS,T/LEAF 2C	2	FIG 2.5-4 J10-11	1-583692-1	AMP	(P)	13.09
T970400056	CONNECTOR,DUAL,25POS,T/LEAF,2C	1	FIG 2.5-4 J9	2-583692-4	AMP	(P)	27.59
T970400062	HEADER,SINGLE,5POS,WLOCK,MWX64	1	FIG 2.5-4 P5	09-65-1051	MOLEX	(P)	1.36
T970400091	CONNECTOR,DUAL,44POS,T/LEAF,2C	1	FIG 2.5-4 J8	4-583692-2	AMP	(P)	38.03
T971400001	SOCKET,IC,14DIP,.1X.3CTR	8	FIG 2.5-4 XDS46-	2-641261-1(1ST PREF)	AMP	(P)	1.36
			XDS53	703-4214-01-04-10	CAMBION	(2)	1.36
T971600111	SWITCH,PB,MOMENTARY,1STA,SPST	16	FIG 2.5-4 S1-S16	320.02-E1-1BLACKBODY	ELEC COMPNT GROUP	(P)	3.67
T972600005	SPEAKER,8OHM,.16W,.51MAGNT	1	FIG 2.5-4 MP5	25SP002	MOUSER ELECTRONICS	(P)	12.13
				S-A0200	MARVOX	(2)	12.13
A112500601	ASSY, PCB, PROCESSOR		FIG 2.6-14				
200100001	RES,0.0R,1/4W,5%, CF	1	FIG 2.6-14 R18	ZEROHM	TRW-IRC	(P)	.24
				OMA07	CORNING	(2)	.24
200101015	RES,100R,1/4W,5%, CF	14	FIG 2.6-14 R21,27	CF-1/4-100R-5%	TRW-IRC	(P)	.32
			R30,31,38,39,54,	CF-1/4-100R-5%	STACKPOLE	(2)	.32
			R57,77,79,83,86,				.32
			R91,92				.32
200101025	RES,1.0K,1/4W,5%, CF	4	FIG 2.6-14 R5,6,	CF-1/4-1.0K-5%	TRW-IRC	(P)	.24
			R14 15	CF1/4-1.0K-5%	STACKPOLE	(2)	.2
200101035	RES,10K,1/4W,5%, CF	5	FIG 2.6-14 R4,16	CF-1/4-10K-5%	TRW-IRC	(P)	.32
			R37	CF1/4-10K-5%	STACKPOLE	(2)	.32
			FIG 2.6-14 R72,74				
200101045	RES,100K,1/4W,5%, CF	4	FIG 2.6-14 R50,58	CF-1/4-100K-5%	TRW-IRC	(P)	.32
			R93-94	CF1/4-100K-5%	STACKPOLE	(2)	.3
200101055	RES,1.0M,1/4W,5%, CF	2	FIG 2.6-14 R71,73	CF-1/4-1.0M-5%	TRW-IRC	(P)	.39
				CF1/4-1.0M-5%	STACKPOLE	(2)	.39
200103315	RES,330R,1/4W,5%, CF	2	FIG 2.6-14 R106,	CF-1/4-330R-5%	TRW-IRC	(P)	.08
			R107	CF-1/4-330R-5%	STACKPOLE	(2)	.0
200104725	RES,4.7K,1/4W,5%, CF	1	FIG 2.6-14 R87	CF-1/4-4.7K-5%	TRW-IRC	(P)	.08
200104735	RES,47K,1/4W,5%, CF	2	FIG 2.6-14 R63,89	CF-1/4-47K-5%	TRW-IRC	(P)	.08
220210001	RES,100R,.25W,1%,100PPM, MF	1	FIG 2.6-14 R75	SMA4100R1%;C[T]4100R	CORNING	(2)	.24
				LM3D1000F	VERMONT P	(P)	.24
220210011	RES,1.00K,.25W,1%,100PPM, MF	5	FIG 2.6-14 R13,19	SMA41.00K1%;C[T]41.0	CORNING	(2)	.16
			R20,22-23	LM3D1001F	VERMONT P	(P)	.16
220210021	RES,10.0K,.25W,1%,100PPM, MF	15	FIG 2.6-14 R104,	SMA410.0K1%;C[T]410.	CORNING	(2)	.16
			R105,29,33-35,43,	LM3D1002F	VERMONT P	(P)	.16
			R48-49,55,66-67,				
			R70,81,85				
220210221	RES,10.2K,.25W,1%,100PPM MF	1	FIG 2.6-14 R7	SMA410.2K1%;C[T]410.	CORNING	(2)	.16
				LM3D1022F	VERMONT P	(P)	.16
220210521	RES,10.5K,.25W,1%,100PPM MF	1	FIG 2.6-14 R76	SMA410.5K1%;C[T]410.	CORNING	(2)	.16
				LM3D1052F	VERMONT P	(P)	.16
220210531	RES,105K,.25W,1%,100PPM, MF	1	FIG 2.6-14 R9	SMA4105K1%;C[T]4105K	CORNING	(2)	.24
				LM3D1053F	VERMONT P	(P)	.24
220211031	RES,110K,.25W,1%,100PPM, MF	1	FIG 2.6-14 R65	SMA4110K1%;C[T]4110K	CORNING	(2)	.16
				LM3D1103F	VERMONT P	(P)	.16
220212121	RES,12.1K,.25W,1%,100PPM, MF	1	FIG 2.6-14 R28	SMA412.1K1%;C[T]412.	CORNING	(2)	.16
				LM3D1212F	VERMONT P	(P)	.16
220214311	RES,1.43K,.25W,1%,100PPM, MF	1	FIG 2.6-14 R45	SMA41.43K1%;C[T]41.4	CORNING	(2)	.24
				LM3D1431F	VERMONT P	(P)	.24
220215021	RES,15.0K,.25W,1%,100PPM, MF	1	FIG 2.6-14 R47	SMA415.0K1%;C[T]415.	CORNING	(2)	.16
				LM3D1502F	VERMONT P	(P)	.16

Part No.	Description	Qty Asem.	Ref Deg	MFG/Vendor Part#	MFG Name	Source	Price
220215431	RES,154K,.25W,1%,100PPM, MF	1	FIG 2.6-14 R52	SMA4154K1%;C[T]4154K	CORNING	(2)	.24
				LM3D1543F	VERMONT P	(P)	.24
220220021	RES,20.0K,.25W,1%,100PPM, MF	2	FIG 2.6-14 R40,64	SMA420.0K1%;C[T]420.	CORNING	(2)	.16
				LM3D2002F	VERMONT P	(P)	.16
220220031	RES,200K,.25W,1%,100PPM, MF	1	FIG 2.6-14 R59	SMA4200K1%;C[T]4200K	CORNING	(2)	.16
				LM3D2003F	VERMONT P	(P)	.16
220220511	RES,2.05K,.25W,1%,100PPM, MF	1	FIG 2.6-14 R90	SMA42.05K1%;C[T]42.0	CORNING	(2)	.16
				LM3D2051F	VERMONT P	(P)	.16
220222111	RES,2.21K,.25W,1%,100PPM, MF	1	FIG 2.6-14 R11	SMA42.21K1%;C[T]42.2	CORNING	(2)	.16
				LM3D2211F	VERMONT P	(P)	.16
220223211	RES,2.32K,.25W,1%,100PPM, MF	1	FIG 2.6-14 R60	SMA42.32K1%;C[T]42.3	CORNING	(2)	.16
				LM3D2321F	VERMONT P	(P)	.16
220229411	RES,2.94K,.25W,1%,100PPM, MF	1	FIG 2.6-14 R82	SMA42.94K1%;C[T]42.9	CORNING	(2)	.40
				LM3D2941F	VERMONT P	(P)	.40
220230111	RES,3.01K,.25W,1%,100PPM, MF	2	FIG 2.6-14 R68,69	SMA43.01K1%;C[T]43.0	CORNING	(2)	.16
				LM3D3011F	VERMONT P	(P)	.16
220242211	RES,4.22K,.25W,1%,100PPM, MF	1	FIG 2.6-14 R17	SMA44.22K1%;C[T]44.2	CORNING	(2)	.16
				LM3D4221F	VERMONT P	(P)	.16
220245321	RES,45.3K,.25W,1%,100PPM, MF	1	FIG 2.6-14 R12	SMA445.3K1%;C[T]445.	CORNING	(2)	.16
				LM3D4532F	VERMONT P	(P)	.16
220247521	RES,47.5K,.25W,1%,100PPM, MF	1	FIG 2.6-14 R10	SMA447.5K1%;C[T]447.	CORNING	(2)	.24
				LM3D4752F	VERMONT P	(P)	.24
220249911	RES,4.99K,.25W,1%,100PPM, MF	2	FIG 2.6-14 R32,56	SMA44.99K1%;C[T]44.9	CORNING	(2)	.16
				LM3D4991F	VERMONT P	(P)	.16
220259001	RES,590R,.25W,1%,100PPM, MF	1	FIG 2.6-14 R61	SMA4590R1%;C[T]4590R	CORNING	(2)	.16
				LM3D5900F	VERMONT P	(P)	.16
220259011	RES,5.90K,.25W,1%,100PPM, MF	1	FIG 2.6-14 R2	SMA45.90K1%;C[T]45.9	CORNING	(2)	.16
				LM3D5901F	VERMONT P	(P)	.16
220259021	RES,59.0K,.25W,1%,100PPM, MF	1	FIG 2.6-14 R8	SMA459.0K1%;C[T]459.	CORNING	(2)	.16
				LM3D5902F	VERMONT P	(P)	.16
220269811	RES,6.98K,.25W,1%,100PPM, MF	1	FIG 2.6-14 R41	SMA46.98K1%;C[T]46.9	CORNING	(2)	.24
				LM3D6981F	VERMONT P	(P)	.24
220280611	RES,8.06K,.25W,1%,100PPM, MF	1	FIG 2.6-14 R53	SMA48.06K1%;C[T]48.0	CORNING	(2)	.16
				LM3D8061F	VERMONT P	(P)	.16
220295311	RES,9.53K,.25W,1%,100PPM, MF	1	FIG 2.6-14 R3	SMA49.53K1%;C[T]49.5	CORNING	(2)	.24
				LM3D9531F	VERMONT P	(P)	.24
232701025	TRIM-POT,1.0K,18T, CER	1	FIG 2.6-14 R42	68WR1.0K	BECKMAN	(2)	7.58
				3299W-1-102	BOURNS	(P)	7.58
232702017	TRIM-POT,200R,18T, CER	1	FIG 2.6-14 R44	68WR200	BECKMAN	(2)	7.66
				3299W-1-201	BOURNS	(P)	7.66
330004700	CAP,47PF, CER	1	FIG 2.6-14 C85	CCD-470	ARCO	(P)	.32
				D470K29S2LNAAAL	CENTRALAB	(2)	.32
510004001	INT-CKT,CMOS,4001,BUF	1	FIG 2.6-14 U50	MC14001B[AL,CL,CP]	MOTOROLA	(P)	1.18
				CD4001B[CN,CJ,MJ]	NAT SEMI	(2)	1.18
510004013	INT-CKT,CMOS,4013,BUF	1	FIG 2.6-14 U42	MC14013B[AL,CL,CP]	MOTOROLA	(2)	6.27
				CD4013B[CN,CJ,MJ]	NAT SEMI	(P)	6.27
510004042	INT-CKT,CMOS,4042,BUF	8	FIG 2.6-14 U8,15,	MC14042B[AL,CL,CP]	MOTOROLA	(2)	2.11
			U9,27,29,31-32,47	CD4042B[CN,CJ,MJ]	NAT SEMI	(P)	2.11
510004093	INT-CKT,CMOS,4093,BUF	1	FIG 2.6-14 U25	MC14093B[AL,CL,CP]	MOTOROLA	(2)	1.20
				CD4093B[CN,CJ,MJ]	NAT SEMI	(P)	1.20
510907400	INT-CKT,LS-TTL,74LS00	2	FIG 2.6-14 U21,46	74LS00[PC,DC,DM]	FAIRCHILD	(P)	1.12
				SN74LS00[A][J,N]	TEX INST	(2)	1.12
				DM74LS00[J,N]	NAT SEMI	(P)	1.12
510907404	INT-CKT,LS-TTL,74LS04	1	FIG 2.6-14 U23	SN74LS04[A][J,N]	TEX INST	(P)	1.36

Part No.	Description	Qty Asem.	Ref Deg		MFG/Vendor Part#	MFG Name		Source Price
510907474	INT-CKT,LS-TTL,74LS74	2	FIG 2.6-14	U4-5	SN74LS74[J,N]	MOTOROLA	(P)	1.13
					DM74LS74[J,N]	NAT SEMI	(2)	1.13
510907492	INT-CKT,LS-TTL,74LS92	1	FIG 2.6-14	U34	SN74LS92[J,N]	MOTOROLA	(P)	3.59
					DM74LS92[J,N]	NAT SEMI	(2)	3.59
510974123	INT-CKT,LS-TTL,74LS123	1	FIG 2.6-14	U26	SN74LS123[J,N]	MOTOROLA	(2)	4.63
					DM74LS123[J,N]	NAT SEMI	(P)	4.63
510974175	INT-CKT,LS-TTL,74LS175	1	FIG 2.6-14	U16	SN74LS175[J,N]	MOTOROLA	(2)	2.07
					DM74LS175[J,N]	NAT SEMI	(P)	2.07
510974273	INT-CKT,LS-TTL,74LS273	3	FIG 2.6-14	U18,19	SN74LS273[J,N]	MOTOROLA	(2)	2.55
				U22	DM74LS273[J,N]	NAT SEMI	(P)	2.55
510974283	INT-CKT,LS-TTL,74LS283	5	FIG 2.6-14	U7,10	SN74LS283[J,N]	MOTOROLA	(P)	3.67
				U28,30,33	DM74LS283[J,N]	NAT SEMI	(2)	3.67
514001611	INT-CKT,INTERFACE,8279-5	1	FIG 2.6-14	U58	P8279-5	INTEL CORP	(P)	19.36
					UPD8279C-5	NEC	(2)	19.36
514500102	RES,NETWORK,8X10K,	2	FIG 2.6-14	U54-55	898-3-R10K	BECKMAN	(2)	2.15
					4116R-001-103	BOURNS	(P)	2.15
863400801	TERMINAL,QUICK DIS,MALE	37	FIG 2.6-14	TP1-37	61137-1	AMP	(P)	.34
R112500306	SCHEMATIC,PROCESSOR BOARD	0	REF					.00
R112500346	SCHEMATIC,WR DELAY	0						.00
R112500406	PERF SPEC,PROCESSOR BD	0	REF					.00
T112500701	PCB,PROCESSOR,	1	FIG 2.6-14	MP1				158.60
T112502801	STIFFENER,SHIELD V/F&PROC BD'S	1	FIG 2.6-14	MP2				30.48
T810120603	SCR,PANHD,Z/N,6-32X.187,SS 6.1	4	FIG 2.6-14	MP3	6-32 X 3/16	ACCURATE FASTENERS	(P)	.24
T814864881	WASHER,INT LOCK,SS,#6X.03125	4	FIG 2.6-14	MP4	#6 SST INT LOCK	ACCURATE FASTENERS	(P)	.16
T859000007	JACK,CLSD ENTRY,PC,.040PN1.176	2	FIG 2.6-14	XJ2	450-3704-1-04	CAMBION	(P)	2.39
T910100004	CAP,0.05UF,25V,20%,DISK, CER	52	FIG 2.6-14	C1-14,	LC473M	MALLORY	(2)	.40
				17-18,23-25,29-37	UK25-503	CENTRALAB	(P)	.40
				40-43,45,47-48,56				
				58-60,62,65,81-83				
				68-75				
T910100015	CAP,20PF,1KV,10%,DISK, CER	1	FIG 2.6-14	C44	DD-200	CENTRALAB	(P)	.64
					GP420 REV-CRIMP	MALLORY	(2)	.64
T910100052	CAP,1.0UF,50V,20%, MONO CER	1	FIG 2.6-14	C49	30050Z5U105M	ARCO	(P)	1.68
					C330C105M5R5CA	KEMET	(2)	1.68
T910100058	CAP,0.0047UF,50V,10%, MONO CER	1	FIG 2.6-14	C15	CK05BX472K	SPRAGUE	(P)	.88
					CK05BX472K TRIM .1"	MURATA-ERIE	(2)	.88
T910100059	CAP,0.0056UF,200V,10%,MONO CER	1	FIG 2.6-14	C16	CK06BX562K	SPRAGUE	(P)	1.68
					CK06BX562K TRIM .1"	MURATA-ERIE	(2)	1.68
T910200044	CAP,1.0UF,35V,10%,DIPPED TANT	2	FIG 2.6-14	C39,	196D105X9035HA1	SPRAGUE	(P)	.96
				C64	T362A105K035AS	KEMET	(2)	.96
T910200058	CAP,15UF,35V,20%,DIPPED, TANT	3	FIG 2.6-14	C76-	196D156X9035PE4	SPRAGUE	(P)	5.51
				C78	T362C156K035AS	KEMET	(2)	5.51
T910200063	CAP,68UF,6V,10%,DIPPED, TANT	2	FIG 2.6-14	C54,	196D686X9006KA1	SPRAGUE	(P)	2.07
				C55	T362B686K006AS	KEMET	(2)	2.07
T910400022	CAP,500PF,500V,5%,DIPPED, MICA	2	FIG 2.6-14	C52,	CD15FD501J03	CORNELL-D	(P)	1.76
				C53	DM15-501J	ARCO	(2)	1.76
T910400024	CAP,360PF,500V,5%,DIPPED, MICA	1	FIG 2.6-14	C19	CD15FD361J03	CORNELL-D	(P)	1.52
					DM15-361J	ARCO	(2)	1.52
T910400026	CAP,22PF,500V,5%,DIPPED, MICA	1	FIG 2.6-14	C22	CD15ED220J03	CORNELL-D	(P)	.64
					CM05ED220J03	ARCO	(2)	.64
T910400031	CAP,150PF,500V,5%,DIPPED, MICA	1	FIG 2.6-14	C26	D155F151J0	SANGAMO	(P)	.96
					DM15-151J	ARCO	(2)	.96
T910500003	CAP,0.15UF,100V,5%, POLY	1	FIG 2.6-14	C28	217A1B154J	ELECTROCUBE	(P)	6.06

Part No.	Description	Qty Assem.	Ref Deg		MFG/Vendor Part#	MFG Name		Source Price
					XP2442J	IMB	(2)	6.06
T910500025	CAP,0.047UF,100V,5%, POLY	1	FIG 2.6-14	C38	230B1B473J	ELECTROCUBE	(P)	3.75
					A11B473J	BISHOP CAPACITORS	(2)	3.75
T910500030	CAP,0.01UF,100V,1%, POLYCARB	2	FIG 2.6-14	C50, C51	627A1B103F	ELECTROCUBE	(P)	9.74
					C31B103F	BISHOP CAPACITORS	(2)	9.74
T910700021	CAP,0.0047UF,100V,1%, POLYCARB	3	FIG 2.6-14	C63, C66-67	C31B472F	BISHOP CAPACITORS	(2)	8.70
					PC11-.0047-100-1	F-DYNE	(P)	8.70
T910900001	CAP,1.0UF,100V,5%, POLY	1	FIG 2.6-14	C27	1J100	WESTLAKE	(P)	2.87
T912200001	CAP,18PF,5.5>TRIMMER, VERT MTG	1	FIG 2.6-14	C20	300322-207	STETTNER	(P)	4.39
T912200007	CAP,40PF,8>TRIMMER, VERT MTG	2	FIG 2.6-14	C21, C57	300322-520	STETTNER	(P)	5.51
T930200006	RES,10K,.125W,.1%, MF	3	FIG 2.6-14	R1,R80 R88	RN60C 10.000K0.1% C2	DALE	(P)	1.68
T930200062	RES,7.41K,.125W,.1%, MF	1	FIG 2.6-14	R25	RN60C 7.410K0.1% C2	DALE	(P)	1.52
T930501623	RES,162K,.125W,1%, MF	3	FIG 2.6-14	R36, R46	CMF-55-T2/T1/T9	DALE	(2)	.40
					CRB14FX/162K	R-OHM	(P)	.40
		3	FIG 2.6-14	R51	CMF-55-T2/T1/T9	DALE	(2)	.40
					CRB14FX/162K	R-OHM	(P)	.40
T930510931	RES,93.1R,.125W,1%, MF	1	FIG 2.6-14	R26	CMF-55T-2	DALE	(2)	.08
					CRB14FX/93.1 OHM	R-OHM	(P)	.08
T930700203	RES,20K,.25W,5%, CF	1	FIG 2.6-14	R84	R-25J	R-OHM	(P)	.08
					RC07GF203J	ALLEN BRADLEY	(2)	.08
T930700224	RES,220K,.25W,5%, CF	1	FIG 2.6-14	R62	ERD-25TJ224	PANASONIC	(P)	.08
					R-25J	R-OHM	(2)	.08
T930700225	RES,2.2M,.25W,5%, CF	1	FIG 2.6-14	R24	ERD-25TJ225	PANASONIC	(P)	.40
					R-25J	R-OHM	(2)	.40
T930700300	RES,30R,.25W,5%, CF	8	FIG 2.6-14	R95-R102	R-25J	R-OHM	(P)	.40
					RC07GF300J	ALLEN BRADLEY	(2)	.40
T930700563	RES,56K,.25W,5%, CF	1	FIG 2.6-14	R78	ERD-25TJ563	PANASONIC	(P)	.08
					R-25J	R-OHM	(2)	.08
T940200031	DIODE,MBD101V(BR) 4V 1R10 UA	2	FIG 2.6-14	CR6, CR7	MBD101	MOTOROLA	(P)	1.68
T940200032	DIODE,SIGNAL,1N4148,75PIV	14	FIG 2.6-14	CR1-5, CR8-16	1N4148	R-OHM	(2)	.16
					J1N4148	ITT	(P)	.16
T952000171	INT-CKT,OP-AMP,072/082,2XNT,JFET,	3	FIG 2.6-14	U12,13 U61	TL072CP-TESTED(SUB)	TEX INST	(P)	2.59
T952000173	INT-CKT,OP-AMP,081,JFET,INT CM	1	FIG 2.6-14	U52	TL071CP-TESTED(SUB)	TEX INST	(P)	1.57
T952000189	INT-CKT,COMPARTR,339,4X V BUFR	1	FIG 2.6-14	U3	LM339N	NAT SEMI	(P)	2.71
					LM339AN	NAT SEMI	(2)	2.71
T952000200	INT-CKT,COMPARTR,311 VOLTAGE	1	FIG 2.6-14	U51	LM311N-TESTED	NAT SEMI	(P)	3.83
T952000202	INT-CKT,OP-AMP,084,4X,JFET	1	FIG 2.6-14	U24	TL074CN	TEX INST	(P)	6.30
T952000217	INT-CKT,DAC,7524,8BIT,16DIL	1	FIG 2.6-14	U1	MPS7524JN	MICRO POWER SYSTEMS	(P)	32.63
					MPS7524KN	MICRO POWER SYSTEMS	(2)	32.63
T952000221	INT-CKT,OP-AMP,2505,PREC,HI SL	1	FIG 2.6-14	U35	HA3-2505-5	HARRIS	(P)	21.15
					HA7-2505-5	HARRIS	(2)	21.15
T952000222	INT-CKT,DAC,3410,10BIT,MULTIPL	1	FIG 2.6-14	U14	MC3410CL	MOTOROLA	(P)	50.61
					MC3410L	MOTOROLA	(2)	50.61
T952000225	INT-CKT,VOLT-REF,LH00700,10.00	1	FIG 2.6-14	U60	AD581L	ANALOG DEVICES	(2)	39.12
					AD581K	ANALOG DEVICES	(P)	39.12
T954100017	INT-CKT,LS-TTL,74LS107A,2XJKFF	1	FIG 2.6-14	U20	DM74LS107N	NAT SEMI	(P)	2.23
					SN74LS107AN	TEX INST	(2)	2.23
T955000004	INT-CKT,CMOS,4049,HEX INVERTER	1	FIG 2.6-14	U45	CD4049UBF (AT RISK)	RCA	(2)	2.79

Part No.	Description	Qty Asem.	Ref Deg		MFG/Vendor Part#	MFG Name		Source Price
					MC14049UB (AT RISK)	MOTOROLA	(P)	2.79
1955000024	INT-CKT,CMOS,4043,3X,NOR R-S L	1	FIG 2.6-14	U2	CD4043B	RCA	(2)	5.27
					MC14043B	MOTOROLA	(P)	5.27
1955000036	INT CKT,CMOS,4515,4VIT,LATCH	1	FIG 2.6-14	U37	CD4515B	RCA	(P)	7.18
					MC14515 [B,BCP]	MOTOROLA	(2)	7.18
1955000044	INT-CKT,CMOS,4556,2X,DECOD/DEM	2	FIG 2.6-14	U44,	CD4556B	RCA	(P)	5.35
				U53	MC14556B	MOTOROLA	(2)	5.35
1955000070	INT CKT,CMOS,74C42,BCD:DEC DEC	2	FIG 2.6-14	U36,	CD74HC42E (AT RISK)	RCA	(2)	7.18
				U48	MM74C42N (AT RISK)	NAT SEMI	(P)	7.18
1955000078	INT CKT,ANASW,DG211,4XSPST,ANL	2	FIG 2.6-14	U11,	DG211CJ	SILICONIX	(P)	11.81
				U43	DG211CK	SILICONIX	(2)	11.81
1956000027	INT CKT,TIMER,8253,PROG INT	1	FIG 2.6-14	U41	8253-5	INTEL CORP	(P)	22.58
					UPD8253C-5	NEC	(2)	22.58
1956000052	INT CKT,CLOCK,58167	1	FIG 2.6-14	U40	MM58167AN	NAT SEMI	(P)	54.72
1956000069	INT-CKT,UP8,80C39C,NEC ONLY	1	FIG 2.6-14	U49	UPD80C39C	NEC	(P)	26.25
1957000045	RES,10K,.75W,P,7COMCONF,ARRAY	1	FIG 2.6-14	U17	108A103	ALLEN BRADLEY	(P)	.96
					MSP08C01-103J,G,F	DALE	(2)	.96
1957500005	TRANSISTOR ARRAY,2803,DARL,HV	1	FIG 2.6-14	U57	SGS603B	SGS SEMI	(2)	5.51
					ULN2803A	SPRAGUE	(P)	5.51
1960100012	TRANSISTOR,2N5139,20V,200MWPNP	1	FIG 2.6-14	Q1	PN5139	NAT SEMI	(P)	.72
1960100036	TRANSISTOR,MPSD54,PNP,DARL/HIB	14	FIG 2.6-14	Q2-Q15	MPSD54	MOTOROLA	(P)	1.76
1970500042	CRYSTAL,6.144MHZ,30PF,100T,50S	1	FIG 2.6-14	Y1	FOX061 (+3RD LEAD)	FOX CRYSTL	(P)	7.58
					MP061	CTS	(2)	7.58
1970500043	CRYSTAL,4.194304MHZ,12PF100T50	1	FIG 2.6-14	Y2	FOX041 (+3RD LEAD)	FOX CRYSTL	(P)	12.53
					MP041 (+3RD LEAD)	CTS	(2)	12.53
1970500044	CRYSTAL,32.768KHZ,1.4PF.035T10	1	FIG 2.6-14	Y3	B0001-354-01	TTI SPEC.	(2)	23.22
					CX-1V-32.768KHZ-A-03	STATEK	(P)	23.22
1970700031	INDUCTOR,LINE NOISE,SUPPRESSOR	3	FIG 2.6-14	E1,E2,	B0001-250-01	SPEC	(P)	2.87
				E3				
1971600003	SOCKET,IC,24DIP,.1X.6CTR	3	FIG 2.6-14	XU37,	2-641266-1(1ST PREF)	AMP	(2)	1.52
				XU40,41	703-1324-01-04-10	CAMBION	(P)	1.52
1971600018	SOCKET,IC,40DIP,.1X.6CTR	2	FIG 2.6-14	XU49,	2-641268-1(1ST PREF)	AMP	(2)	4.55
				XU58	703-4240-01-04-10	CAMBION	(P)	4.55
1971600020	SOCKET,IC,28DIP,.1X.6CTR	3	FIG 2.6-14	XU6,38	641267-1 (1ST PREF)	AMP	(2)	1.28
				XU39	703-4228-01-04-10	CAMBION	(P)	1.28
1971600021	SOCKET,IC,20DIP,.1X.3CTR	3	FIG 2.6-14	XU18,	2-640464-1	AMP	(P)	1.28
				XU19,22	2-641264-1 (1ST PREF	AMP	(2)	1.28
1971600023	SOCKET,IC,18DIP,.1X.3CTR	1	FIG 2.6-14	XU57	2-641263-1(1ST PREF)	AMP	(2)	1.52
					703-4218-01-04-10	CAMBION	(P)	1.52
4112500800	FIRMWARE, MOPAR, 1125							
5146000504	INT-CKT,EPROM,2732	1			AM2732DC	AMD	(2)	34.50
		1			D2732A	INTEL CORP	(P)	34.50
4112500700	SOFTWARE,MOPAR,1125	0						.00
4112500703	SOFTWARE,SIXE ROM,1125	0						.00
5146000504	INT-CKT,EPROM,27C64,C,5KXS	2			MBM27C64-25	FUJITSU	(2)	33.08
		2			HN27C64G-15	HITACHI	(P)	33.08
4112500801	ASSEMBLY, VFF BD.		FIG 2.7-8					
2001210[illegible]	RES,100R,1/4W,5%,	CF	6	FIG 2.7-8	R11,14,	CF-1/4-100R-5%	TRW-IRC	(P)	.32
					R55,61,109,134	CF-1/4-100R-5%	STACKPOLE	(2)	.32
2001210[illegible]	RES,10K,1/4W,5%	CF	3	FIG 2.7-8	R58,74,	CF-1/4-10K-5%	TRW-IRC	(P)	.32
					R83	CF1/4-10K-5%	STACKPOLE	(2)	.32
2001210[illegible]	RES,100K,1/4W,5%	CF	6	FIG 2.7-8	R1-5,	CF-1/4-100K-5%	TRW-IRC	(P)	.32
					R44	CF1/4-100K-5%	STACKPOLE	(2)	.32
2001210[illegible]	RES,1.0M,1/4W,5%	CF	1	FIG 2.7-8	R125	CF-1/4-1.0M-5%	TRW-IRC	(P)	.39

Part No.	Description		Qty Asem.	Ref Deg		MFG/Vendor Part#	MFG Name		Source Price
						CF1/4-1.0M-5%	STACKPOLE	(2)	.39
200103315	RES,330R,1/4W,5%,	CF	1	FIG 2.7-8	R6	CF-1/4-330R-5%	TRW-IRC	(P)	.08
						CF-1/4-330R-5%	STACKPOLE	(2)	.08
200105125	RES,5.1K,1/4W,5%,	CF	3	FIG 2.7-8	R21,29, 45	CF-1/4-5.1K-5%	TRW-IRC	(P)	.08
						CF-1/4-5.1K-5%	STACKPOLE	(2)	.08
220210001	RES,100R,.25W,1%,100PPM,	MF	2	FIG 2.7-8	R32.R38	SMA4100R1%;C[T]4100R	CORNING	(2)	.24
						LM3D1000F	VERMONT P	(P)	.24
220210021	RES,10.0K,.25W,1%,100PPM,	MF	6	FIG 2.7-8	R26,69, R75,98,105,106	SMA410.0K1%;C[T]410.	CORNING	(2)	.16
						LM3D1002F	VERMONT P	(P)	.16
220210721	RES,10.7K,.25W,1%,100PPM,	MF	2	FIG 2.7-8	R117, R118	SMA410.7K1%;C[T]410.	CORNING	(2)	.16
						LM3D1072F	VERMONT P	(P)	.16
220211011	RES,1.10K,.25W,1%,100PPM,	MF	1	FIG 2.7-8	R47	SMA41.10K1%;C[T]41.1	CORNING	(2)	.16
						LM3D1101F	VERMONT P	(P)	.16
220211321	RES,11.3K,.25W,1%,100PPM,	MF	1	FIG 2.7-8	R19	SMA411.3K1%;C[T]411.	CORNING	(2)	.24
						LM3D1132F	VERMONT P	(P)	.24
220211821	RES,11.8K,.25W,1%,100PPM,	MF	1	FIG 2.7-8	R126	SMA411.8K1%;C[T]411.	CORNING	(2)	.24
						LM3D1182F	VERMONT P	(P)	.24
220212421	RES,12.4K,.25W,1%,100PPM,	MF	2	FIG 2.7-8	R91,R95	SMA412.4K1%;C[T]412.	CORNING	(2)	.16
						LM3D1242F	VERMONT P	(P)	.16
220214331	RES,143K,.25W,1%,100PPM,	MF	2	FIG 2.7-8	R82,R90	SMA4143K1%;C[T]4143K	CORNING	(2)	.32
						LM3D1433F	VERMONT P	(P)	.32
220214721	RES,14.7K,.25W,1%,100PPM,	MF	1	FIG 2.7-8	R122	SMA414.7K1%;C[T]414.	CORNING	(2)	.16
						LM3D1472F	VERMONT P	(P)	.16
220216511	RES,1.65K,.25W,1%,100PPM,	MF	2	FIG 2.7-8	R51,R56	SMA41.65K1%;C[T]41.6	CORNING	(2)	.24
						LM3D1651F	VERMONT P	(P)	.24
220216921	RES,16.9K,.25W,1%,100PPM,	MF	2	FIG 2.7-8	R101, R121	SMA416.9K1%;C[T]416.	CORNING	(2)	.16
						LM3D1692F	VERMONT P	(P)	.16
220217421	RES,17.4K,.25W,1%,100PPM,	MF	2	FIG 2.7-8	R96,R97	SMA417.4K1%;C[T]417.	CORNING	(2)	.24
						LM3D1742F	VERMONT P	(P)	.24
220219621	RES,19.6K,.25W,1%,100PPM,	MF	1	FIG 2.7-8	R20	SMA419.6K1%;C[T]419.	CORNING	(2)	.24
						LM3D1962F	VERMONT P	(P)	.24
220220521	RES,20.5K,.25W,1%,100PPM,	MF	1	FIG 2.7-8	R116	SMA420.5K1%;C[T]420.	CORNING	(2)	.40
						LM3D2052F	VERMONT P	(P)	.40
220221521	RES,21.5K,/25W,1%,100PPM,	MF	3	FIG 2.7-8	R16,22, R111	SMA421.5K1%;C[T]421.	CORNING	(2)	.16
						LM3D2152F	VERMONT P	(P)	.16
220222111	RES,2.21K,.25W,1%,100PPM,	MF	4	FIG 2.7-8	R15,50. R114-115	SMA42.21K1%;C[T]42.2	CORNING	(2)	.16
						LM3D2211F	VERMONT P	(P)	.16
220222611	RES,2.26K,.25W,1%,100PPM,	MF	3	FIG 2.7-8	R104, R107,113	SMA42.26K1%;C[T]42.2	CORNING	(2)	.24
						LM3D2261F	VERMONT P	(P)	.24
220223711	RES,2.37K,.25W,1%,100PPM,	MF	1	FIG 2.7-8	R46	SMA42.37K1%;C[T]42.3	CORNING	(2)	.24
						LM3D2371F	VERMONT P	(P)	.24
220230121	RES,30.1K,.25W,1%,100PPM,	MF	1	FIG 2.7-8	R7	SMA430.1K1%;C[T]430.	CORNING	(2)	.16
						LM3D3012F	VERMONT P	(P)	.16
220231611	RES,3.16K,.25W,1%,100PPM,	MF	1	FIG 2.7-8	R40	SMA43.16K1%;C[T]43.1	CORNING	(2)	.24
						LM3D3161F	VERMONT P	(P)	.24
220231621	RES,31.6K,.25W,1%,100PPM,	MF	2	FIG 2.7-8	R132, R133	SMA431.6K1%;C[T]431.	CORNING	(2)	.16
						LM3D3162F	VERMONT P	(P)	.16
220239221	RES,39.2K,.25W,1%,100PPM,	MF	1	FIG 2.7-8	R119	SMA439.2K1%;C[T]439.	CORNING	(2)	.24
						LM3D3922F	VERMONT P	(P)	.24
220241211	RES,4.12K,.25W,1%,100PPM,	MF	2	FIG 2.7-8	R108, R109	SMA44.12K1%;C[T]44.1	CORNING	(2)	.32
						LM3D4121F	VERMONT P	(P)	.32
220241221	RES,41.2K,.25W,1%,100PPM,	MF	1	FIG 2.7-8	R120	SMA441.2K1%;C[T]441.	CORNING	(2)	.24
						LM3D4122F	VERMONT P	(P)	.24
220244221	RES,44.2K,.25W,1%,100PPM,	MF	1	FIG 2.7-8	R100	SMA444.2K1%;C[T]444.	CORNING	(2)	.16

Part No.	Description		Qty Asem.	Ref Deg		MFG/Vendor Part#	MFG Name		Source Price
						LM3D4422F	VERMONT P	(P)	.16
220246411	RES,4.64K,.25W,1%,100PPM,	MF	1	FIG 2.7-8	R41	SMA44.64K1%;C[T]44.6	CORNING	(2)	.16
						LM3D4641F	VERMONT P	(P)	.16
220249911	RES,4.99K,.25W,1%,100PPM,	MF	4	FIG 2.7-8	R112,	SMA44.99K1%;C[T]44.9	CORNING	(2)	.16
					R124,128.139	LM3D4991F	VERMONT P	(P)	.16
220251121	RES,51.1K,.25W,1%,100PPM,	MF	2	FIG 2.7-8	R31,	SMA451.1K1%;C[T]451.	CORNING	(2)	.16
					R37	LM3D5112F	VERMONT P	(P)	.16
220257611	RES,5.76K,.25W,1%,100PPM,	MF	1	FIG 2.7-8	R43	SMA45.76K1%;C[T]45.7	CORNING	(2)	.16
						LM3D5761F	VERMONT P	(P)	.16
220260411	RES,6.04K,.25W,1%,100PPM,	MF	1	FIG 2.7-8	R127	SMA46.04K1%;C[T]46.0	CORNING	(2)	.24
						LM3D6041F	VERMONT P	(P)	.24
220261901	RES,619R,.25W,1%,100PPM,	MF	2	FIG 2.7-8	R57,R58	SMA4619R1%;C[T]4619R	CORNING	(2)	.16
						LM3D6190F	VERMONT P	(P)	.16
220261911	RES,6.19K,.25W,1%,100PPM,	MF	2	FIG 2.7-8	R130,	SMA46.19K1%;C[T]46.1	CORNING	(2)	.16
					R131	LM3D6191F	VERMONT P	(P)	.16
220266521	RES,66.5K,.25W,1%,100PPM,	MF	1	FIG 2.7-8	R123	SMA466.5K1%;C[T]466.	CORNING	(2)	.24
						LM3D6652F	VERMONT P	(P)	.24
220268121	RES,68.1K,.25W,1%,100PPM,	MF	2	FIG 2.7-8	R80,R84	SMA468.1K1%;C[T]468.	CORNING	(2)	.16
						LM3D6812F	VERMONT P	(P)	.16
220271521	RES,71.5K,.25W,1%,100PPM,	MF	2	FIG 2.7-8	R85,R94	SMA471.5K1%;C[T]471.	CORNING	(2)	.16
						LM3D7152F	VERMONT P	(P)	.16
220275001	RES,750R,.25W,1%,100PPM,	MF	2	FIG 2.7-8	R17,R23	SMA4750R1%;C[T]4750R	CORNING	(2)	.16
						LM3D7500F	VERMONT P	(P)	.16
220275021	RES,75.0K,.25W,1%,100PPM,	MF	1	FIG 2.7-8	R81	SMA475.0K1%;C[T]475.	CORNING	(2)	.24
						LM3D7502F	VERMONT P	(P)	.24
220282521	RES,82.5K,.25W,1%,100PPM,	MF	1	FIG 2.7-8	R87	SMA482.5K1%;C[T]482.	CORNING	(2)	.16
						LM3D8252F	VERMONT P	(P)	.16
220284501	RES,845R,.25W,1%,100PPM,	MF	2	FIG 2.7-8	R62,R63	SMA4845R1%;C[T]4845R	CORNING	(2)	.16
						LM3D8450F	VERMONT P	(P)	.16
220288711	RES,8.87K,.25W,1%,100PPM,	MF	1	FIG 2.7-8	R62,R35	SMA48.87K1%;C[T]48.8	CORNING	(2)	.16
						LM3D8871F	VERMONT P	(P)	.16
220290911	RES,9.09K,.25W,1%,100PPM,	MF	2	FIG 2.7-8	R102,	SMA49.09K1%;C[T]49.0	CORNING	(2)	.24
					R103	LM3D9091F	VERMONT P	(P)	.24
220297611	RES,9.76K,.25W,1%,100PPM,	MF	1	FIG 2.7-8	R27	SMA49.76K1%;C[T]49.7	CORNING	(2)	.16
						LM3D9761F	VERMONT P	(P)	.16
232701035	TRIM-POT,10K,18T,	CER	4	FIG 2.7-8	R138	68WR10K	BECKMAN	(2)	7.50
				R33,79,92		3299W-1-103	BOURNS	(P)	7.50
232702024	TRIM-POT,2.0K,18T,	CER	3	FIG 2.7-8	R18,36,	68WR2.0K	BECKMAN	(2)	7.66
					42	3299W-1-202	BOURNS	(P)	7.66
335402511	CAP,250PF,500V,1%,	MICA	1	FIG 2.7-8	C11	CD15FD251F03	CORNELL-D	(P)	2.80
						CM05FD251F03DM15251F	ARCO	(2)	2.80
510004042	INT-CKT,CMOS,4042,BUF		7	FIG 2.7-8	U2-U8	MC14042B[AL,CL,CP]	MOTOROLA	(2)	2.11
						CD4042B[CN,CJ,MJ]	NAT SEMI	(P)	2.11
510004051	INT-CKT,CMOS,4051,BUF		1	FIG 2.7-8	U11	MC14051B[AL,CL,CP]	MOTOROLA	(2)	2.71
						CD4051B[CN,CJ,MJ]	NAT SEMI	(P)	2.71
514500107	RES,NETWORK,8X100K,		1	FIG 2.7-8	U1	898-3-R100K	BECKMAN	(2)	2.15
						4116R-001-104	BOURNS	(P)	2.15
556051150	TRANSISTOR,JFET,PCH,2N5115		2	FIG 2.7-8	Q1,2	2N5115	INTERSIL	(P)	11.89
						2N5115	SILICONIX	(2)	11.89
560041520	DIODE,SIGNAL,1N4152		5	FIG 2.7-8	CR3-7	1N4152	TEX INST	(P)	.24
						1N4152	ITT	(2)	.24
863400801	TERMINAL,QUICK DIS,MALE		32	FIG 2.7-8	MP1	61137-1	AMP	(P)	.34
R112500308	SCHEMATIC,V/F BOARD		0	REF					.00
R112500408	PERF SPEC,V/F BD		0	REF					.00

Part No.	Description	Qty Assem.	Ref Dsg	MFG/Vendor Part#	MFG Name		Source Price
T112500901	PRINTED CIRCUIT BOARD, VF	1	FIG 2.7-8 MP33				98.44
T112502801	STIFFENER,SHIELD V/F&PROC BD'S	1	FIG 2.7-8 MP34				30.48
T811120604	SCR,PANHD,SS,6-32X.250,SS 6.34	4	FIG 2.7-8 MP35	6-32X1/4 SST	ACCURATE FASTENERS	(P)	.40
T814864881	WASHER,INT LOCK,SS,#6X.03125	4	FIG 2.7-8 MP36	#6 SST INT LOCK	ACCURATE FASTENERS	(P)	.16
T910100004	CAP,0.05UF,25V,20%,DISK, CER	47	FIG 2.7-8 C1-8, C10,12-15,19-21, C24,25,27-33,35, C39,49-50,53-57, C60,61,63,65,66, C115-122	LC473M	MALLORY	(2)	.40
				UK25-503	CENTRALAB	(P)	.40
T910200045	CAP,10.0UF,25V,10%,DIPPED,TANT	3	FIG 2.7-8 C62,C64 C67	* 196D106X9025KA1	SPRAGUE	(P)	1.26
				T368B106K025AS	KEMET	(2)	1.26
T910200084	CAP,10.0UF,25V,20%, ELECTRO	30	FIG 2.7-8 C16,18, C22-23,26,34, C36-38,42,44,45, C51-52,69,71-73, C77,82,86,88,92, C94,98,104, C108-110,113	SL25VB10	U CHEMICON	(2)	.43
				UKB1E100	NICHICON	(P)	.43
T910400023	CAP,110PF,500V,5%,DIPPED, MICA	1	FIG 2.7-8 C123	CD15FD111J03	CORNELL-D	(P)	.72
				CM05FD111J03	ARCO	(2)	.72
T910400026	CAP,22PF,500V,5%,DIPPED, MICA	1	FIG 2.7-8 C17	CD15ED220J03	CORNELL-D	(P)	.64
				CM05ED220J03	ARCO	(2)	.64
T910400039	CAP,82PF,500V,5%,DIPPED, MICA	1	FIG 2.7-8 C40	CD15FD820J03	CORNELL-D	(2)	.72
				CM05ED820J03	ARCO	(P)	.72
T910400051	CAP,300PF,500V,1%,DIPPED, MICA	1	FIG 2.7-8 C78	CD15FD301F03	CORNELL-D	(P)	1.68
				CM05FD301F03	ARCO	(2)	1.68
T910400053	CAP,1100PF,100V,1%,DIPPED,MICA	2	FIG 2.7-8 C46,C90	CD15FA112F03	CORNELL-D	(P)	3.51
				DM15-112F	ARCO	(2)	3.51
T910400055	CAP,620PF,300V,1%,DIPPED, MICA	1	FIG 2.7-8 C47	CD15FC621F03	CORNELL-D	(P)	2.71
				DM15 621F	ARCO	(2)	2.71
T910400056	CAP,2200PF,500V,1%,DIPPED,MICA	1	FIG 2.7-8 C85	CD19FD222F03	CORNELL-D	(P)	3.51
				CM06FD222F03	ARCO	(2)	3.51
T910400057	CAP,1200PF,100V,1%,DIPPED,MICA	6	FIG 2.7-8 C43,48, C76,95,111-112	CD15FA122F03	CORNELL-D	(P)	2.95
				DM15-122F	ARCO	(2)	2.95
T910400058	CAP,2400PF,500V,1%,DIPPED,MICA	5	FIG 2.7-8 C80,83, C96,106,107	CD19FD242F03	CORNELL-D	(P)	3.83
				CM06FD242F03	ARCO	(2)	3.83
T910400059	CAP,1700PF,500V,1%,DIPPED,MICA	10	FIG 2.7-8 C41,68, C70,74-75,81,84, C87,91,93	CD19FD172F03	CORNELL-D	(2)	3.35
				CM06FD172F03	ARCO	(P)	3.35
T910500013	CAP,0.001UF,100V,1%, POLYCARB	3	FIG 2.7-8 C9,102, 103	BV2B102F	IMB	(P)	9.34
				C31B102F	BISHOP CAPACITORS	(2)	9.34
T910500030	CAP,0.01UF,100V,1%, POLYCARB	5	FIG 2.7-8 C89,97, C99,100,114	627A1B103F	ELECTROCUBE	(P)	9.74
				C31B103F	BISHOP CAPACITORS	(2)	9.74
T910700017	CAP,0.068UF,50V,1%, POLYCARB	1	FIG 2.7-8 C105	BV2A683F	IMB	(P)	8.86
				C31A683F	BISHOP CAPACITORS	(2)	8.86
T910700021	CAP,0.0047UF,100V,1%, POLYCARB	1	FIG 2.7-8 C79	C31B472F	BISHOP CAPACITORS	(2)	8.70
				PC11-.0047-100-1	F-DYNE	(P)	8.70
T910700031	CAP,0.022UF,100V,1%, POLYCARB	1	FIG 2.7-8 C101	C31B223F	BISHOP CAPACITORS	(2)	8.86
				PC11-.022-100-1	F-DYNE	(P)	8.86
T930200001	RES,1K,.125W,.1%, MF	2	FIG 2.7-8 R10, R137	RN60C 1.000K0.1% C2	DALE	(P)	1.36
T930200003	RES,3.162K,.125W,.1%, MF	4	FIG 2.7-8 R53,64, R71,78	RN60C 3.162K0.1% C2	DALE	(P)	1.68

Part No.	Description	Qty Asem.	Ref Deg	MFG/Vendor Part#	MFG Name		Source Price
T930200004	RES,6.838K,.125W,.1%, MF	6	FIG 2.7-8 R8,54, R65,70,77,135	RN60C 6.838K0.1% C2	DALE	(P)	1.68
T930200006	RES,10K,.125W,.1%, MF R25,28,30,39	14	FIG 2.7-8 R12,24, R48-49,66,72,86, R88-89,93	RN60C 10.000K0.1% C2	DALE	(P)	1.68
T930200129	RES,1.111K,.125W,.1%, MF	3	FIG 2.7-8 R13,67, 73	RN60C 1.111K0.1% C2	DALE	(P)	3.67
T930200134	RES,5.012K,.125W,.1%, MF	1	FIG 2.7-8 R34	RN60C 5.012K0.1% C2	DALE	(P)	1.52
T930200159	RES,2.162K,.125W,.1%, MF	2	FIG 2.7-8 R9,R136	RN60C 2.162K0.1% C2	DALE	(P)	1.84
T930502873	RES,287K,.25W,1%, MF	1	FIG 2.7-8 R9,R110	CMF-55-T2/T1/T9	DALE	(2)	.08
				CRB14FX/287K	R-OHM	(P)	.08
T930503573	RES,357K,.125W,1%, MF	1	FIG 2.7-8 R99	CMF-55-T2/T1/T9	DALE	(2)	.08
				CRB14FX/357K	R-OHM	(P)	.08
T940200032	DIODE,SIGNAL,1N4148,75PIV	4	FIG 2.7-8 CR1,2, CR8,9	1N4148	R-OHM	(2)	.16
				J1N4148	ITT	(P)	.16
T952000214	INT-CKT,OP-AMP,353A,2X,JFET	3	FIG 2.7-8 U22,32, U35	LF353N	HARRIS	(2)	3.83
				LF353N/A+ (TESTED)	NAT SEMI	(P)	3.83
T952000215	INT-CKT,OP-AMP,351,JFET,8 DIP	4	FIG 2.7-8 U12,U18	LF351N/A+ TESTED	NAT SEMI	(P)	4.07
		4	FIG 2.7-8 U19,U30	LF351N/A+ TESTED	NAT SEMI	(P)	4.07
T952000216	INT-CKT,OP-AMP,347,4X,JFET,14D	7	FIG 2.7-8 U15,23,	LF347N/A+ (TESTED)	NAT SEMI	(P)	4.47
			U31,33-34,36-37	LF347N	HARRIS	(2)	4.47
T952000219	INT-CKT,VOLT-FREQ,VFC32,V>F CO	1	FIG 2.7-8 U9	VFC32KP	BURR-BROWN	(P)	43.16
T952000220	INT-CKT,DAC,7541,12BIT,MULTIPL	1	FIG 2.7-8 U13	AD7541AJN	ANALOG DEVICES	(2)	41.86
				MP7541JN	MICRO POWER SYSTEMS	(P)	41.86
T952000221	INT-CKT,OP-AMP,2505,PREC,HI SL	4	FIG 2.7-8 U20,21, U24-25	HA3-2505-5	HARRIS	(P)	21.15
				HA7-2505-5	HARRIS	(2)	21.15
T955000036	INT-CKT,CMOS,4515,4VIT,LATCH	1	FIG 2.7-8 U28	CD4515B	RCA	(P)	7.18
				MC14515 [B,BCP]	MOTOROLA	(2)	7.18
T955000060	INT-CKT,ANASW,DG508,3XBCD,8CHN	2	FIG 2.7-8 U17,U27	DG508ACJ	SILICONIX	(2)	24.50
				HI508A-2	HARRIS	(P)	24.50
T955000078	INT-CKT,ANASW,DG211,4XSPST,ANL	4	FIG 2.7-8 U14,16, U26,29	DG211CJ	SILICONIX	(P)	11.81
				DG211CK	SILICONIX	(2)	11.81
T955000086	INT-CKT,CMOS,4504,HEX,LEVEL SH	1	FIG 2.7-8 U10	MC14504B	MOTOROLA	(P)	4.07
T970700031	INDUCTOR,LINE NOISE,SUPPRESSOR	3	FIG 2.7-8 E1-E3	TT121	SOUTH AMERICAN DEVEL	(P)	2.87
T971400003	SOCKET,IC,24DIP,.1X.6CTR	1	FIG 2.7-8 XU28	2-641266-1(1ST PREF)	AMP	(2)	1.52
				703-1324-01-04-01	CAMBION	(P)	1.52
T971400023	SOCKET,IC,18DIP,.1X.3CTR	1	FIG 2.7-8 XU13	2-641263-1(1ST PREF)	AMP	(2)	1.52
				703-4218-01-04-10	CAMBION	(P)	1.52
A112500900	FGS, 1125, IMP, PORT, 115 VAC/BAT						
A112500011	ASSY,PROCESSOR BD,W/FIRMWARE	1					.00
A112500101	ASSY,O/A,TTS,IMP. NOISE,DC	1					733.87
A112500401	ASSY,PCB,DISPLAY	1					400.00
A112500600	MANUAL,1125	1					53.70
A112500801	ASSY,PCB,V/F	1					573.28
A112501001	ASSY,PCB,I/O	1					752.00
A112501401	ASSY,FRONT PANEL	1					248.82
A112502901	ASSY,PCB,DC PWR SUPPLY	1					278.25
R112500307	SCHEMATIC,DC POWER SUPPLY	0	REF				.00
R112500407	PERF SPEC,POWER SUPPLY DC	0	REF				.00
R112500875	TEST,RESULTS,1125	0	ENG. REF				.00
A112501001	ASSEMBLY PCB, I/O		FIG 2.8-4				

Part No.	Description		Qty Assem.	Ref Deg	MFG/Vendor Part#	MFG Name		Source Price
200101005	RES,10R,1/4W,5%,	CF	1	FIG 2.8-4 R86	CF1/4-10R-5%	TRW-IRC	(P)	.24
					CF1/4-10R-5%	STACKPOLE	(2)	.24
200101015	RES,100R,1/4W,5%,	CF	2	FIG 2.8-4 R25,26	CF-1/4-100R-5%	TRW-IRC	(P)	.32
					CF-1/4-100R-5%	STACKPOLE	(2)	.32
200101025	RES,1.0K,1/4W,5%,	CF	4	FIG 2.8-4 R113,	CF-1/4-1.0K-5%	TRW-IRC	(P)	.24
				R118,121,126	CF1/4-1.0K-5%	STACKPOLE	(2)	.24
200101035	RES,10K,1/4W,5%,	CF	3	FIG 2.8-4 R24,71,	CF-1/4-10K-5%	TRW-IRC	(P)	.32
				R88	CF1/4-10K-5%	STACKPOLE	(2)	.32
200101045	RES,100K,1/4W,5%,	CF	12	FIG 2.8-4 R23,97,	CF-1/4-100K-5%	TRW-IRC	(P)	.32
				R100-109	CF1/4-100K-5%	STACKPOLE	(2)	.32
200101055	RES,1.0M,1/4W,5%,	CF	4	FIG 2.8-4 R112,	CF-1/4-1.0M-5%	TRW-IRC	(P)	.39
				R119-120,127	CF1/4-1.0M-5%	STACKPOLE	(2)	.39
200104715	RES,470R,1/4W,5%,	CF	4	FIG 2.8-4 R114,	CF-1/4-470R-5%	TRW-IRC	(P)	.08
				R117,122,125	CF-1/4-470R-5%	STACKPOLE	(2)	.08
220210011	RES,1.00K,.25W,1%,100PPM,	MF	5	FIG 2.8-4 R20,33,	SMA41.00K1%;C[T]41.0	CORNING	(2)	.16
				R34,55,110	LM3D1001F	VERMONT P	(P)	.16
220210021	RES,10.0K,.25W,1%,100PPM,	MF	1	FIG 2.8-4 R69	SMA410.0K1%;C[T]410.	CORNING	(2)	.16
					LM3D1002F	VERMONT P	(P)	.16
220210031	RES,100K,.25W,1%,100PPM,	MF	5	FIG 2.8-4 R30,38,	SMA4100K1%;C[T]4100K	CORNING	(2)	.16
				R39,90-91	LM3D1003F	VERMONT P	(P)	.16
220210091	RES,10.0R,.25W,1%,100PPM,	MF	1	FIG 2.8-4 R95	CMF55-T1-10.0R1%	DALE	(P)	.16
					SMA410.0R1%;C[T]410.	CORNING	(2)	.16
220210521	RES,10.5K,.25W,1%,100PPM	MF	1	FIG 2.8-4 R62	SMA410.5K1%;C[T]410.	CORNING	(2)	.16
					LM3D1052F	VERMONT P	(P)	.16
220213331	RES,133K,.25W,1%,100PPM,	MF	1	FIG 2.8-4 R46	SMA4133K1%;C[T]4133K	CORNING	(2)	.16
					LM3D1333F	VERMONT P	(P)	.16
220215821	RES,15.8K,.25W,1%,100PPM,	MF	4	FIG 2.8-4 R65-68	SMA415.8K1%;C[T]415.	CORNING	(2)	.16
					LM3D1582F	VERMONT P	(P)	.16
220219631	RES,196K,.25W,1%,100PPM,	MF	1	FIG 2.8-4 R64	SMA4196K1%;C[T]4196K	CORNING	(2)	.24
					LM3D1963F	VERMONT P	(P)	.24
220220031	RES,200K,.25W,1%,100PPM,	MF	3	FIG 2.8-4 R19,21,	SMA4200K1%;C[T]4200K	CORNING	(2)	.16
				R45	LM3D2003F	VERMONT P	(P)	.16
220221031	RES,210K,.25W,1%,100PPM,	MF	4	FIG 2.8-4 R56,58	SMA4210K1%;C[T]4210K	CORNING	(2)	.24
				R59,61	LM3D2103F	VERMONT P	(P)	.24
220226701	RES,267R,.25W,1%,100PPM,	MF	1	FIG 2.8-4 R94	SMA4267R1%;C[T]4267R	CORNING	(2)	.16
					LM3D2670F	VERMONT P	(P)	.16
220226731	RES,267K,.25W,1%,100PPM,	MF	5	FIG 2.8-4 R47,49,	SMA4267K1%;C[T]4267K	CORNING	(2)	.16
				R50,51,54	LM3D2673F	VERMONT P	(P)	.16
220227411	RES,2.74K,.25W,1%,100PPM,	MF	1	FIG 2.8-4 R42	SMA42.74K1%;C[T]42.7	CORNING	(2)	.24
					LM3D2741F	VERMONT P	(P)	.24
220229421	RES,29.4K,.25W,1%,100PPM,	MF	1	FIG 2.8-4 R111	SMA429.4K1%;C[T]429.	CORNING	(2)	.16
					LM3D2942F	VERMONT P	(P)	.16
220230121	RES,30.1K,.25W,1%,100PPM,	MF	2	FIG 2.8-4 R52,60	SMA430.1K1%;C[T]430.	CORNING	(2)	.16
					LM3D3012F	VERMONT P	(P)	.16
220234811	RES,3.48K,.25W,1%,100PPM,	MF	1	FIG 2.8-4 R87	SMA43.48K1%;C[T]43.4	CORNING	(2)	.24
					LM3D3481F	VERMONT P	(P)	.24
220251121	RES,51.1K,.25W,1%,100PPM,	MF	1	FIG 2.8-4 R85	SMA451.1K1%;C[T]451.	CORNING	(2)	.16
					LM3D5112F	VERMONT P	(P)	.16
220268121	RES,68.1K,.25W,1%,100PPM,	MF	1	FIG 2.8-4 R84	SMA468.1K1%;C[T]468.	CORNING	(2)	.16
					LM3D6812F	VERMONT P	(P)	.16
220273221	RES,73.2K,.25W,1%,100PPM,	MF	1	FIG 2.8-4 R89	SMA473.2K1%;C[T]473.	CORNING	(2)	.24
					LM3D7322F	VERMONT P	(P)	.24
220278711	RES,7.87K,.25W,1%,100PPM,	MF	1	FIG 2.8-4 R57	SMA47.87K1%;C[T]47.8	CORNING	(2)	.24
					LM3D7871F	VERMONT P	(P)	.24

Part No.	Description	Qty Asem.	Ref Deg	MFG/Vendor Part#	MFG Name		Source Price
220282511	RES,8.25K,.25W,1%,100PPM, MF	1	FIG 2.8-4 R48	SMA48.25K1%;C[T]48.2	CORNING	(2)	.24
				LM3D8251F	VERMONT P	(P)	.24
220286621	RES,86.6K,.25W,1%,100PPM, MF	2	FIG 2.8-4 R43,44	SMA486.6K1%;C[T]486.	CORNING	(2)	.24
				LM3D8662F	VERMONT P	(P)	.24
220290911	RES,9.09K,.25W,1%,100PPM, MF	1	FIG 2.8-4 R83	SMA49.09K1%;C[T]49.0	CORNING	(2)	.24
				LM3D9091F	VERMONT P	(P)	.24
220297611	RES,9.76K,.25W,1%,100PPM, MF	1	FIG 2.8-4 R53	SMA49.76K1%;C[T]49.7	CORNING	(2)	.16
				LM3D9761F	VERMONT P	(P)	.16
232702017	TRIM-POT,200R,18T, CER	1	FIG 2.8-4 R31	68WR200	BECKMAN	(2)	7.66
				3299W-1-201	BOURNS	(P)	7.66
232702024	TRIM-POT,2.0K,18T, CER	1	FIG 2.8-4 R27	68WR2.0K	BECKMAN	(2)	7.66
				3299W-1-202	BOURNS	(P)	7.66
232705014	TRIM-POT,500R,18T, CER	3	FIG 2.8-4 R11,18, R22	68WR500	BECKMAN	(P)	7.50
335401021	CAP,1.0NF, SIL MICA	1	FIG 2.8-4 C55	CM05FA102J03(CD15)	CORNELL-D	(P)	3.03
500000083	INT-CKT,OP-AMP,082B	1	FIG 2.8-4 U10	TL082BC[JG,P]	TEX INST	(P)	6.78
500000386	INT-CKT,PWR-AMP,386	1	FIG 2.8-4 U12	LM386N-1	NAT SEMI	(P)	4.47
510004042	INT-CKT,CMOS,4042,BUF	1	FIG 2.8-4 U3	MC14042B[AL,CL,CP]	MOTOROLA	(2)	2.11
				CD4042B[CN,CJ,MJ]	NAT SEMI	(P)	2.11
650410001	JACK,TELEPHONE,3CND2B	2	FIG 2.8-4 MP1,2	PC-388J	AD	(P)	6.78
650410002	COVER,JACK,	2	FIG 2.8-4 MP3,4	PC-388C	AD	(P)	.80
802201005	SCR,SEMS,SLOT,SS,4-40X.312	4	FIG 2.8-4 MP5	4-40X.312	ACCURATE FASTENERS	(P)	.16
863400801	TERMINAL,QUICK DIS,MALE	24	FIG 2.8-4 MP6-29	61137-1	AMP	(P)	.34
R112500310	SCHEMATIC,I/O BOARD	0	REF				.00
R112500410	PERF SPEC,I/O BD	0	REF				.00
T112501101	PCB,I/O	1	FIG 2.8-4 MP30				83.83
T811120605	SCR,PANHD,SS,6-32X..312,SS 6.2	2	FIG 2.8-4 MP31	MS5233-27	ACCURATE FASTENERS	(P)	.24
T813110600	SCR,TEF-COAT,9704X248 & 249	4	FIG 2.8-4 MP32	4-24174-0020	ADC	(P)	.88
T814620404	NUT,KEP,SS,4.19,4-40X.25	4	FIG 2.8-4 MP33	4-40 SST KEP NUT	ACCURATE FASTENERS	(P)	.24
T814630600	NUT,KEP,SS,621,SM PATRN,#6-32	2	FIG 2.8-4 MP34	6-32 SST SM PATTRNKP	OLANDER	(P)	.24
T852000006	SOLDER LUG,BRASS LOCK,#6,1.16	4	FIG 2.8-4 MP35	1416-6	H.H.SMITH	(P)	.16
T853000010	CABLE,TIE,3.6LX.1WX.6DX18#	2	FIG 2.8-4 MP36	PLT1M-MP	PANDUIT	(P)	.16
T866000005	INSULATOR,SEMICONDUCTOR,1.100	4	FIG 2.8-4 MP37	7403-09FR-51	BERGQUIST	(P)	.96
T910100004	CAP,0.05UF,25V,20%,DISK, CER	20	FIG 2.8-4 C7-16, C36-38,40-42,44, C50-51,54	LC473M	MALLORY	(2)	.40
				UK25-503	CENTRALAB	(P)	.40
T910100006	CAP,0.1UF,25V,20%,DISK, CER	1	FIG 2.8-4 C56	HY-550	SPRAGUE	(2)	1.84
				UK25-104	CENTRALAB	(P)	1.84
T910100052	CAP,1.0UF,50V,20%, MONO CER	1	FIG 2.8-4 C39	30050Z5U105M	ARCO	(P)	1.68
				C330C105M5R5CA	KEMET	(2)	1.68
T910200011	CAP,47/50UF,16V,20%, ELECTRO	2	FIG 2.8-4 C45,46	500D506G016CB7	SPRAGUE	(P)	3.91
				TE1160	SPRAGUE	(2)	3.91
T910200016	CAP,220UF,6V,C%, ELECTRO	1	FIG 2.8-4 C57	B41283-220-6.3	SIEMENS	(P)	.96
T910200044	CAP,1.0UF,35V,10%,DIPPED TANT	1	FIG 2.8-4 C43	196D105X9035HA1	SPRAGUE	(P)	.96
				T362A105K035AS	KEMET	(2)	.96
T910200045	CAP,10.0UF,25V,10%,DIPPED,TANT	5	FIG 2.8-4 C25,26, C49,52-53	* 196D106X9025KA1	SPRAGUE	(P)	1.26
				T3688106K025AS	KEMET	(2)	1.26
T910200051	CAP,220UF,6V,10%,DIPPED, TANT	1	FIG 2.8-4 C58	T362D227K006AS	KEMET	(P)	7.74
T910200084	CAP,10.0UF,25V,20%, ELECTRO	15	FIG 2.8-4 C6,18 C22-23,30-31,48 C59-66	SL25VB10	U CHEMICON	(2)	.43
				UKB1E100	NICHICON	(P)	.43
T910200100	CAP,47UF,250V,20%, NONP	2	FIG 2.8-4 C4,5	NA-2248-47-250-M	RICHEY	(P)	21.47
T910400011	CAP,220PF,500V,5%,DIPPED, MICA	1	FIG 2.8-4 C20	CD15FD221J03	CORNELL-D	(P)	1.04
				DM15-221J	ARCO	(2)	1.04

Part No.	Description	Qty Asem.	Ref Deg	MFG/Vendor Part#	MFG Name		Source Price
T910500030	CAP,0.01UF,100V,1%, POLYCARB	8	FIG 2.8-4 C17,19, C28-29,32-35	627A1B103F	ELECTROCUBE	(P)	9.74
				C31B103F	BISHOP CAPACITORS	(2)	9.74
T910500034	CAP,1.0UF,200V,5%, POLY	1	FIG 2.8-4 C3	A11C105J	ELECTROCUBE	(P)	5.27
				ZA2C105J	IMB	(2)	5.27
T910700007	CAP,0.022UF,50V,5%, POLYCARB	1	FIG 2.8-4 C47	BV2A223J	IMB	(2)	4.95
				C31A223J	ELECTROCUBE	(P)	4.95
T930200001	RES,1K,.125W,.1%, MF	3	FIG 2.8-4 R35,81, R128	RN60C 1.000K0.1% C2	DALE	(P)	1.36
T930200019	RES,30.623K,.125W,.1%, MF	1	FIG 2.8-4 R36	RN60C 30.623K0.1% C2	DALE	(P)	3.91
T930200075	RES,2.901K,.125W,.1%, MF	2	FIG 2.8-4 R77,82	RN60C 2.901K0.1% C2	DALE	(P)	4.31
T930200146	RES,1.147K,.125W,.1%, MF	2	FIG 2.8-4 R79,80	RN60C 1.147K0.1% C2	DALE	(P)	3.67
T930200151	RES,2.835K,.125W,.1%, MF	1	FIG 2.8-4 R78	RN60C 2.835K0.1% C2	DALE	(P)	3.91
T930200153	RES,200R,.125W,.1%, MF	1	FIG 2.8-4 R75	RN60C 200.0-0.1% C2	DALE	(P)	3.03
T930503163	RES,316K,.125W,1%, MF	2	FIG 2.8-4 R63,70	CMF-55-T2/T1/T9	DALE	(2)	.08
				CRB14FX/316K	R-OHM	(P)	.08
T930510806	RES,80.6R,.125W,1%, MF	1	FIG 2.8-4 R93	CRB14FX/80.6 OHM	R-OHM	(P)	.40
T930510931	RES,93.1R,.125W,1%, MF	4	FIG 2.8-4 R115, R116,123-124	CMF-55T-2	DALE	(2)	.08
				CRB14FX/93.1 OHM	R-OHM	(P)	.08
T930700392	RES,3.9K,.25W,5%, CF	2	FIG 2.8-4 R41,73	R-25J	R-OHM	(P)	.40
T930700683	RES,68K,.25W,5%, CF	1	FIG 2.8-4 R72	R-25J	R-OHM	(P)	.08
T935101350	RES,135R,5W,.1%, NONIND	2	FIG 2.8-4 R5,10	LRP5N135OHM.1%	LARTRONICS	(2)	17.32
				NWW5-135 OHM-.1%	VERMONT P	(P)	17.32
T935304500	RES,450R,3W,.1%, NONIND	2	FIG 2.8-4 R3,8	MS221N-450 OHM 0.1%	CADDOCK	(P)	7.58
				MSN-3 450 OHM 0.1%	ULTRONICS	(2)	7.58
T935403000	RES,300R,2W,.1%, NONIND	4	FIG 2.8-4 R1,2,6, R7	MS220N-300 OHM	CADDOCK	(P)	12.45
				MSN-2 300 OHM 0.1%	ULTRONICS	(2)	12.45
T935510150	RES,15R,1W,.1%, NONIND	2	FIG 2.8-4 R4,9	EGN-1-80 150OHM 0.1%	DALE	(P)	16.68
				LRP1N150OHM.1%	LARTRONICS	(2)	16.68
T940200005	DIODE,ZENER,1N5231B,5.1V,5%	4	FIG 2.8-4 VR8-11	1N5231B	TELEDYNE	(P)	.48
T940200025	DIODE,RECTIFIER,1N4004,400PIV	4	FIG 2.8-4 CR1-4	1N4004	MOTOROLA	(P)	.40
T940200054	DIODE,ZENER,1N4740A,10V,5%	4	FIG 2.8-4 VR3,4,6 VR7	1N4740A	MOTOROLA	(P)	.56
T952000190	INT-CKT,TIMER,556,2X	1	FIG 2.8-4 U11	NE556	SIGNETICS	(P)	2.07
T952000192	INT-CKT,COMPARTR,393,2X VOLT	1	FIG 2.8-4 U13	LM393AN	NAT SEMI	(P)	4.47
				LM393AN	MOTOROLA	(2)	4.47
T952000216	INT-CKT,OP-AMP,347,4X,JFET,14D	4	FIG 2.8-4 U6-9	LF347N/A+ (TESTED)	NAT SEMI	(P)	4.47
				LF347N	HARRIS	(2)	4.47
T955000022	INT-CKT,CMOS,4532,8BIT,PRIORIT	1	FIG 2.8-4 U14	CD4532B	RCA	(P)	5.51
				MC14532B	MOTOROLA	(2)	5.51
T955000078	INT-CKT,ANASW,DG211,4XSPST,ANL	1	FIG 2.8-4 U1	DG211CJ	SILICONIX	(P)	11.81
				DG211CK	SILICONIX	(2)	11.81
T955000087	INT-CKT,ANASW,5043,ANALOG SW	3	FIG 2.8-4 U2,4,5	HI1-5043-5	HARRIS	(P)	32.16
T960100007	TRANSISTOR,2N5210,50V,350MW	1	FIG 2.8-4 Q7	2N5210NPN	NAT SEMI	(P)	.56
T960100033	TRANSISTOR,MPSA42,300V,625MW	8	FIG 2.8-4 Q1,2,5, Q6,8-9,12-13	MPS-A42	NAT SEMI	(P)	1.20
T961000032	TRANSISTOR,TIP48,300V,2W,NPN	4	FIG 2.8-4 Q3,4, Q10,11	TIP48	TEX INST	(P)	4.79
T970700031	INDUCTOR,LINE NOISE,SUPPRESSOR	3	FIG 2.8-4 E1-3	TT121	SOUTH AMERICAN DEVEL	(P)	2.87
T971600001	SWITCH,PB,PSH PSH,W/FRM,1STA	1	FIG 2.8-4 S4	2UEE	SCHADOW ITT	(P)	8.94
T971600110	SWITCH,ROTARY,PC,3SEC6POS	2	FIG 2.8-4 S2,3	73-8623	ELECTRO SWITCH	(P)	54.66
T971600112	SWITCH,PB,PSH PSH,W/OFRM,1STA	1	FIG 2.8-4 S1	F-004UEEX150101BAG	SCHADOW ITT	(P)	10.13
T971900069	TRANSFORMER,TOROID,0.04-120KHZ	2	FIG 2.8-4 T1,2	1394PC	PACIFIC COIL	(P)	79.09
A112501201	ASSY, CHASSIS, INTERNAL, DC		A112501201				
837100103	EXTRUSION,RUBBER,30FT	0		SC-42-3/16" X 1" X 5	GREENE RUB	(P)	3.10

Part No.	Description	Qty Asem.	Ref Deg		MFG/Vendor Part#	MFG Name		Source Price
T112503101	SIDE PLATE,LT 1125 INT CHASSIS	1						44.39
T112503102	SIDE PLATE,RT 1125 INT CHASSIS	1	A112501201	MP1				44.80
T112503201	RIB SUPPORT,1125 INT CHASSIS	1	A112501201	MP2				53.01
T112503301	BACK PANEL,1125 INT CHASSIS	1	A112501201	MP3				50.55
T112503401	BRACKET,BATTERY COVER	1	A112501201	MP4				42.13
T112503501	BRACKET,MOUNTING,TRANSFORMER	2	A112501201	MP5				20.11
T810120620	SCR,PANHD,Z/N,6-32X.250,SS6.10	4	A112501201	MP6	6-32 X 1-1/4	ACCURATE FASTENERS	(P)	.24
T811120406	SCR,PANHD,SS,4-40X.375,SS 4.2	8	A112501201	MP7	4-40 X 3/8	ACCURATE FASTENERS	(P)	.24
T811120408	SCR,PANHD,SS,4-40X.5,SS 4.3	2	A112501201	MP8	4-40X 1/2	ACCURATE FASTENERS	(P)	.24
T811120604	SCR,PANHD,SS,6-32X.250,SS 6.34	19	A112501201	MP9	6-32X1/4 SST	ACCURATE FASTENERS	(P)	.40
T814620404	NUT,KEP,SS,4.19,4-40X.25	10	A112501201	MP10	4-40 SST KEP NUT	ACCURATE FASTENERS	(P)	.24
T814804781	WASHER,FLAT,Z/N,4.17,#4X.03125	12	A112501201	MP11	#4 ZN/NKL FLAT	OLANDER	(P)	.08
T814864881	WASHER,INT LOCK,SS,#6X.03125	23	A112501201	MP12	#6 SST INT LOCK	ACCURATE FASTENERS	(P)	.16
T816754210	SPACER,ALUM,#6,.625CL,.25RD	4	A112501201	MP13	N06CL X 5/8X1/4 ALUM			1.04
T850000005	TERMINAL,CRIMP,18-24AG/W,1.112	2	A112501201	MP14	08-50-0105 REEL	MOLEX	(P)	.16
T853000008	SCR,TIE CLP,3.9LX.1WX.6DX18#	7	A112501201	MP15	PLC1M-S4-CP	PANDUIT	(P)	.64
					WITS-18MR	RICHCO	(2)	.64
T860200200	TUBING,SHRINK,STB1,BLK,.125	0	A112501201	MP16	HSTT.125	PANDUIT	(P)	2.07
T860200800	TUBING,SHRINK,STB3,BLK,.50	0	A112501201	MP17	HSTT.500	PANDUIT	(P)	.85
T863000003	BUSHING,	2	A112501201	MP18	12SWS0440	MICRO PLASTICS	(P)	.08
T863000005	VINYL BUMPER ADHES BK .38HX.75	2	A112501201	MP19				1.92
T866000005	INSULATOR,SEMICONDUCTOR,1.100	10	A112501201	MP20	7403-09FR-51	BERGQUIST	(P)	.96
T869000018	CLIP,HALF U PLASTIC,.25DIA	2	A112501201	MP21				1.44
T952000185	INT-CKT,VOLT-REG,78M15,+15V,FI	1	A112501201	U3	MC78M15CT	MOTOROLA	(P)	3.92
T952000186	INT-CKT,VOLT-REG,7915,15V,FIX	1	A112501201	U4	MC7915CT (ONLY)	MOTOROLA	(P)	2.74
T961000009	TRANSISTOR,MJE3055,60V,90W,NPN	1	A112501201	G11				19.79
T961000024	TRANSISTOR,2N4922,60V,30W,NPN	2	A112501201	Q8,Q9	2N4922 (MOTA ONLY)	MOTOROLA	(P)	4.15
T961000027	TRANSISTOR,TIP42,40V,2W,PNP	3	A112501201	Q4,Q6, Q10	TIP42	TEX INST	(P)	2.95
T970300004	CORD,POWER,FLYING LEAD,CSA,BLK	1	A112501201	MP22	17535	BELDEN	(P)	14.04
T970400107	HOUSING RECP,2POS,MWX106,WRAMP	1	A112501201	J13	09-50-3021	MOLEX	(P)	.40
T971900081	TRANSFORMER,115/230:16V,CT	1	A112501201	MP23	BE21865-001	BASLER ELECTRIC	(P)	58.60
T972100007	FUSE,SLO-BLO,0.5A,250V,CSA	3	A112501201	MP24, MP25,26	MDL-1/2	BUSSMAN	(P)	1.20
T972200002	FUSE HOLDING,CLIP	2	A112501201	MP27, MP28	A1087	JERMYN	(P)	.56
T972200004	RETAINER,LINE CORD	2	A112501201	MP29, MP30	343-0170-00	TEKTRONICS	(P)	1.68
T972200012	FUSE,CARRIER,DOMESTIC	1	A112501201	MP31	FEK 031.1666 (CSA)	SCHURTER	(P)	3.27
T972200014	FUSE HOLDER,SHORT BODY,PNL B	1	A112501201	MP32	FEU 031.1653	SCHURTER	(P)	6.30
T972500040	BIND.POST,8-32,STUD MTEAL	1	A112501201	MP33	137	H.H.SMITH	(P)	9.10
T972500118	BUSHING,NYLON,0.11IDX0.130D	8	A112501201	MP34	B51547F011	MOTOROLA	(P)	.06
T972500193	BATTERY,6V 10.0AH,RECHRG GEL-C	1	A112501201	MP35	PS6100F2	POWERSONIC	(P)	.00
T972500203	STRAIN,REL PNL,156MAX .26C	1	A112501201	MP36				.24
A112501401	ASSY, FRONT PANEL		A112501401					
650700303	CONNECTOR,HOUSING,4 PIN	1	A112501401	J12	09-50-3041/KK156 SER	MOLEX	(P)	1.04
652400001	BIND.POST,6-32X53/64,STD BLK	4	A112501401	MP1,2, MP3,4	1517-103	H.H.SMITH	(P)	6.85
T112501501	SUB PANEL,FRONT	1	A112501401	MP5				56.20
T112501701	BRACKET,SHIELD,FRONT PANEL	1	A112501401	MP6				52.60
T112502001	LABEL,OVERLAY,FNT PNL,1125	1	A112501401	MP7				59.85
T810120608	SCR,PANHD,Z/N,6-32X.5,SS 6.5	7	A112501401	MP8	6-32 X 1/2	ACCURATE FASTENERS	(P)	.24
T811120605	SCR,PANHD,SS,6-32X..312,SS 6.2	3	A112501401	MP9	MS5233-27	ACCURATE FASTENERS	(P)	.24
T814727600	NUT,CHROME PANEL 1.4,.375-32	1	A112501401	MP10	3/8-32 X 1/2 CHROME	VALLEY PLATING	(P)	.24

Part No.	Description	Qty Asem.	Ref Des	MFG/Vendor Part#	MFG Name		Source Price
T814838062	WASHER,DRESS,1.3,.625X.375	1	A112501401 MP11	S-1022-1	SWITCHCRFT	(P)	.64
T814864881	WASHER,INT LOCK,SS,#6X.03125	10	A112501401 MP12	#6 SST INT LOCK	ACCURATE FASTENERS	(P)	.16
T814867681	WASHER,INT STAR,SS,.375X.01325	1	A112501401 MP13	3/8x1/32 SST INTLOCK	ACCURATE FASTENERS	(P)	.40
T816764803	SPACER,SST,#6,.187CL,.25RD	4	A112501401 MP14	9223-SS140	AMATOM	(P)	5.51
T823000006	ADHESIVE,LOCTITE,SCREW LCH,P.9	0	A112501401 MP15	79-31	LOCTITE	(P)	54.72
T853000008	SCR,TIE CLP,3.9LX.1WX.6DX18#	5	A112501401 MP16	PLC1M-S4-CP	PANDUIT	(P)	.64
				WITS-18MR	RICHCO	(2)	.64
T860200200	TUBING,SHRINK,STB1,BLK,.125	0	A112501401 MP17	HSTT.125	PANDUIT	(P)	2.07
T970300060	CABLE,CSA/UL,300V,22AWG,4COND	1	A112501401 MP18	5004	ALPHA	(P)	4.79
T970400107	HOUSING RECP,2POS,MWX106,WRAMP	1	A112501401 J7	09-50-3021	MOLEX	(P)	.40
T970800006	KNOB,SKIRT,BLKAN,.25SHFT,5/8OD	1	A112501401 MP19	1016-2-B-INDEX	VEMALINE	(P)	20.99
T970800008	KNOB,W SKT,1PTRBK,.25SHFT,.5OD	1	A112501401 MP20	1015-2-B-1 INDEX	VEMALINE	(P)	24.34
T971600107	SWITCH,PSH PUL,W10K POT,OHOPOF	1	A112501401 S1		TAU-TRON	(P)	52.36
A112502901	ASSY, PCB, DC PWR SUPPLY		FIG 2.9-11				
200101025	RES,1.0K,1/4W,5%, CF	3	FIG 2.9-11 R4,7,	CF-1/4-1.0K-5%	TRW-IRC	(P)	.24
			R23	CF1/4-1.0K-5%	STACKPOLE	(2)	.24
200101045	RES,100K,1/4W,5%, CF	1	FIG 2.9-11 R13	CF-1/4-100K-5%	TRW-IRC	(P)	.32
				CF1/4-100K-5%	STACKPOLE	(2)	.32
200102025	RES,2.0K,1/4W,5%, CF	3	FIG 2.9-11 R5,10,	CF-1/4-2.0K-5%	TRW-IRC	(P)	.32
			R15	CF-1/4-2.0K-5%	STACKPOLE	(2)	.32
200105125	RES,5.1K,1/4W,5%, CF	2	FIG 2.9-11 R8,28	CF-1/4-5.1K-5%	TRW-IRC	(P)	.08
				CF-1/4-5.1K-5%	STACKPOLE	(2)	.08
220224931	RES,249K,.25W,1%,100PPM, MF	1	FIG 2.9-11 R25	SMA4249K1%;C[T]4249K	CORNING	(2)	.24
				LM3D2493F	VERMONT P	(P)	.24
220236511	RES,3.65K,.25W,1%,100PPM, MF	1	FIG 2.9-11 R18	SMA43.65K1%;C[T]43.6	CORNING	(2)	.24
				LM3D3651F	VERMONT P	(P)	.24
220240211	RES,4.02K,.25W,1%,100PPM, MF	1	FIG 2.9-11 R9	SMA44.02K1%;C[T]44.0	CORNING	(2)	.17
				LM3D4021F	VERMONT P	(P)	.17
220243221	RES,43.2K,.25W,1%,100PPM, MF	1	FIG 2.9-11 R24	SMA443.2K1%;C[T]443.	CORNING	(2)	.24
				LM3D4322F	VERMONT P	(P)	.24
220256221	RES,56.2K,.25W,1%,100PPM, MF	1	FIG 2.9-11 R26	SMA456.2K1%;C[T]456.	CORNING	(2)	.16
				LM3D5622F	VERMONT P	(P)	.16
220264901	RES,649R,.25W,1%,100PPM, MF	1	FIG 2.9-11 R2	SMA4649R1%;C[T]4649R	CORNING	(2)	.24
				LM3D6490F	VERMONT P	(P)	.24
232702034	TRIM-POT,20K,18T, CER	1	FIG 2.9-11 R19	68WR20K	BECKMAN	(2)	7.66
				3299W-1-203	BOURNS	(P)	7.66
654003601	LOCK,FRICTION,2 CKT	1	FIG 2.9-11 J13	09-65-1021/KK156 SER	MOLEX	(P)	.88
654003603	LOCK,FRICTION,4 CKT	1	FIG 2.9-11 J12	09-65-1041/KK156 SER	MOLEX	(P)	1.36
829805511	STANDOFF,R-SW-AL,6-32	4	FIG 2.9-11 MP1	9545B-A-0632-0	AMATOM	(P)	4.07
863400801	TERMINAL,QUICK DIS,MALE	7	FIG 2.9-11 MP2,3, MP4,5,6,7,8	61137-1	AMP	(P)	.34
R112500307	SCHEMATIC,DC POWER SUPPLY	0	FIG 2.9-11 REF				.00
T112503001	PCB,DC POWER SUPPLY	1	FIG 2.9-11 MP9				32.90
T811120406	SCR,PANHD,SS,4-40X.375,SS 4.2	10	FIG 2.9-11 MP10	4-40 X 3/8	ACCURATE FASTENERS	(P)	.24
T814620404	NUT,KEP,SS,4.19,4-40X.25	10	FIG 2.9-11 MP11	4-40 SST KEP NUT	ACCURATE FASTENERS	(P)	.24
T814864781	WAHER,INT LOCK,SS,#4X.03125	10	FIG 2.9-11 MP12	#4 SST INT LOCK	ACCURATE FASTENERS	(P)	.08
T866000005	INSULATOR,SEMICONDUCTOR,1.100	10	FIG 2.9-11 MP13	7403-09FR-51	BERGQUIST	(P)	.96
T910100004	CAP,0.05UF,25V,20%,DISK, CER	3	FIG 2.9-11 C11,	LC473M	MALLORY	(2)	.40
			C13,17	UK25-503	CENTRALAB	(P)	.40
T910100012	CAP,10PF,1KV,10%,DISK, CER	1	FIG 2.9-11 C16	DD-100	CENTRALAB	(P)	.56
				GPK-100KA REV-CRIMP	MURATA-ERIE	(2)	.56
T910100022	CAP,0.01UF,25V,A%,DISK, CER	4	FIG 2.9-11 C7,8,	UK25-103	CENTRALAB	(P)	1.12

Part No.	Description	Qty Asem.	Ref Des	MFG/Vendor Part#		MFG Name		Source Pri
			C19,20					
T910100038	CAP,0.01UF,200V,10%, MONO CER	1	FIG 2.9-11 C18	CK06BX103K		SPRAGUE	(P)	1.52
				CK06BX103K TRIM .1"		MALLORY	(2)	1.52
T910200045	CAP,10.0UF,25V,10%,DIPPED,TANT	2	FIG 2.9-11 C21,22	* 196D106X9025KA1		SPRAGUE	(P)	1.26
				T368B106K025AS		KEMET	(2)	1.26
T910200074	CAP,100UF,20V,10%,DIPPED, TANT	2	FIG 2.9-11 C6,23	196D107X9020TE4		SPRAGUE	(P)	14.13
				T362D107K020AS		KEMET	(2)	14.13
T910200085	CAP,47UF,35V,10%,DIPPED, TANT	3	FIG 2.9-11 C5,10,	196D476X9035TE4	(A)	SPRAGUE	(P)	13.33
			C12	T362D476K035AS	(E)	KEMET	(2)	13.33
T910200094	CAP,100UF,16V,G%, ELECTRO	2	FIG 2.9-11 C14,15	ECEA1CV101S		PANASONIC	(P)	.72
T910200095	CAP,100UF,35V,G%, ELECTRO	3	FIG 2.9-11 C3,4,9	ECEA1VV101S		PANASONIC	(P)	1.04
				RME-100-35		ARCO	(2)	1.04
T910200098	CAP,4700UF,16V,G%, ELECTRO	2	FIG 2.9-11 C1,2	16RE4700		ELNA	(2)	5.67
				ECEA1CV472S		PANASONIC	(P)	5.67
T920400504	POT,500KOHM,.5W,MULT TRN,TOPAD	1	FIG 2.9-11 R12	3299W-1-50		BOURNS	(2)	7.50
				68WR500K		BECKMAN	(P)	7.50
T930521153	RES,115K,.125W,.25, MF	1	FIG 2.9-11 R20	CRB14-115K-CX		R-OHM	(2)	2.31
				RN55C1153B		CORNING	(P)	2.31
T930522322	RES,23.2K,.125W,.2, MF	1	FIG 2.9-11 R21	CRB14-23.2K-CX		R-OHM	(2)	2.47
				RN55C2322B		CORNING	(P)	2.47
T930700131	RES,130R,.25W,5%, CF	1	FIG 2.9-11 R22	R-25J		R-OHM	(P)	.08
T930700203	RES,20K,.25W,5%, CF	1	FIG 2.9-11 R14	R-25J		R-OHM	(P)	.08
T930700820	RES,82R,.25W,5%, CF	1	FIG 2.9-11 R27	N-25J		R-OHM	(P)	.40
T931300005	RES,.5R,5W,5%, WW	1	FIG 2.9-11 R3	AS-5-0.5 OHM 5%		TRW	(P)	2.47
				CW-5-0.5 OHM 5%		DALE	(2)	2.47
T936001000	RES,100R,1W,5%, WW	1	FIG 2.9-11 R6	AS-1-100-5%		TRW	(P)	4.23
				EGS-1-80-100-5%		DALE	(2)	4.23
T936010500	RES,50R,1W,5%, WW	2	FIG 2.9-11 R11,16	21J50R		OHMITE	(2)	11.01
				RWR-81S49R9RF		DALE	(P)	11.01
T940200005	DIODE,ZENER,1N5231B,5.1V,5%	1	FIG 2.9-11 CR5	1N5231B		TELEDYNE	(P)	.48
T940200018	DIODE,RECTIFIER,1N4001,50PIV,1	2	FIG 2.9-11 CR2,3	1N4001		MOTOROLA	(P)	.40
				1N4001		GENERAL INSTRUMENT	(2)	.40
T940200032	DIODE,SIGNAL,1N4148,75PIV	1	FIG 2.9-11 CR11	1N4148		R-OHM	(2)	.16
				J1N4148		ITT	(P)	.16
T940200033	DIODE,RECTIFIER,1N4936,400PIV	4	FIG 2.9-11 CR7-10	1N4936		MOTOROLA	(P)	1.76
T940200034	DIODE,RECTIFIER,3SM2,200PIV,3A	1	FIG 2.9-11 CR6	3SM2		SEMTECH CORP	(P)	9.41
T940300004	LED,RED,T1,.75 PACKAGE	1	FIG 2.9-11 DS1	521-9200		DIALIGHT	(P)	1.69
T952000181	INT-CKT,VOLT-REF,8212	3	FIG 2.9-11 U1,2,5	ICL8212CPA		INTERSIL	(P)	8.62
T960100027	TRANSISTOR,PE6021,80V,SWITCH	5	FIG 2.9-11 Q2-3,	2N5832		FAIRCHILD	(P)	.55
			Q5,7,12	MPSA06		NAT SEMI	(2)	.55
T970400062	HEADER,SINGLE,5POS,WLOCK,MWX64	1	FIG 2.9-11 J11	09-65-1051		MOLEX	(P)	1.36
T970700014	CHOKE,470UH	1	FIG 2.9-11 L1	WEE-470		NYTRONICS	(P)	10.82
				14S471J		JEFFERS ELECTRONICS	(2)	10.82
T971900059	TRANSFORMER,POWER,DC-DC	1	FIG 2.9-11 T1	TTI SPEC		WESTERN TRANSFORMER	(P)	55.00
A112510800	FIRMWARE, W/PAR, 1125							
R112510700	SOFTWARE,W/PAR,1125	0						.00
T956000056	INT-CKT,EPROM,27C64,C,8KX8	2		MBM27C64-25		FUJITSU	(2)	33.08
				HN27C64G-15		HITACHI	(P)	33.08
A112551900	1125, FRONT COVER							
T1000109001	COVER,ROD	1	A112551900					59.10
T1000109101	DIVIDER	1	A112551900					25.78
T1000110202	PLUNGER,PORTABLE COVER	1	A112551900					26.25
T1000110301	TAPE,FLEX PLASTIC FOAM S/ADH.	1	A112551900			3M	(P)	55.65
T1000132601	COVER,FRONT,	1	A112551900					97.43

Part No.	Description	Qty Asem.	Ref Deg	MFG/Vendor Part#	MFG Name		Source Price
T1000132701	COVER,HOUSING	1	A112551900				84.99
T1000132801	TOP COVER HOUSING	1	A112551900				70.40
T112502701	LABEL,FRONT COVER	1	A112551900				26.01
T810120603	SCR,PANHD,Z/N,6-32X.187,SS 6.1	4	A112551900	6-32 X 3/16	ACCURATE FASTENERS	(P)	.24
T811050604	SCR,FLT,HD,SS,6-32X.250,SS	2	A112551900	6-32X1/4 SST FH	ACCURATE FASTENERS	(P)	.24
T811071008	SCR,UCFH,SS,10-32X.5,SS	4	A112551900	10-32X1/2 UNDRCUT FH	ACCURATE FASTENERS	(P)	.48
T814601000	NUT,KEP,Z/NKL,#10-32,10.12	4	A112551900	10-32 ZN/NKL KEP NUT	ACCURATE FASTENERS	(P)	.32
T814804781	WASHER,FLAT,Z/N,4.17,#4X.03125	2	A112551900	#4 ZN/NKL FLAT	OLANDER	(P)	.08
T814864881	WASHER,INT LOCK,SS,#6X.03125	4	A112551900	#6 SST INT LOCK	ACCURATE FASTENERS	(P)	.16
T819655402	POP RIV,FLT ALUM4/32X2/16 1.50	2	A112551900	AK42BS	USM CO	(P)	.16
T851200001	PIN CLEVIS 1/8X1-1/68K OX 1.10	2	A112551900	1/8X1-1/16 BK OX	OLANDER	(P)	2.63
T851400002	COTTER PIN,1/16X1/4,1.23	2	A112551900	COTTER PIN 1/16X1/4	OLANDER	(P)	.48
T972500019	BUMPER,RUBBER FEET,0.6HIX0.9	4	A112551900	9121	A B BOYD	(P)	2.40
T972500042	SPRING,.8LX.24DIA	2	A112551900	LC035C-9(MUSIC-WIRE)	L&M SUPPLY	(P)	17.80
A112570900	FGS, 1125 PAR OPTION SOFTWARE						
A112510800	FIRMWARE,W/PAR,1125	1	A112551900				58.98

SECTION 4
APPENDIX

4.1 This section contains any information on this Transmission Test Set that is not found in any other section of this manual.

4.2 Self-Test Messages:

When first switched on, the 1125 enters a self-test mode to check its internal circuitry for malfunctions. The results of each test appear in the left display as either PASS or FAIL. The test number appears in the right display. The example below illustrates how the self-test messages appear. The message shown is that the circuit in test number 23 failed. APP-A identifies the 3-kHz filter as the failed circuit.

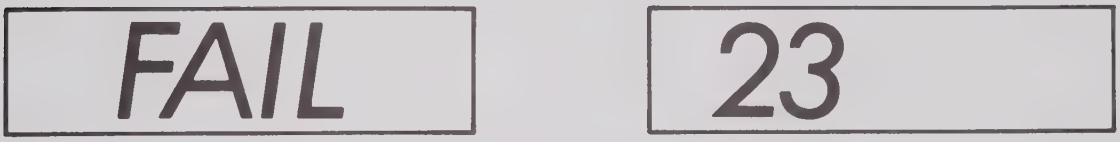


TABLE APP-A
SELF-TEST MESSAGES

TEST NUMBER	CIRCUIT TESTED
1	Accuracy of built-in 10 volt reference
11	Impulse noise measurement
12	P/AR measurement
20	TMS measurement
22	C-message filter
23	3 kHz filter
24	15 kHz filter
25	Program filter
26	50 kbit filter
27	1004 Hz notch filter

SECTION 5
HISTORY

5.1 This section contains the past history of the changes that have been incorporated into this unit since the last overall manual revision. The purpose of this section is to allow this manual to function as a data base for several revisions of this unit.

SECTION 6
DATA SHEET

6.1 This section contains a copy of the current data sheet for this unit. In it will be contained an additional brief description and the specifications for this unit.

tau-tron
A UNIT OF
GENERAL SIGNAL

MODEL 1125

TRANSMISSION TEST SET

Level, Noise, Impulse Noise, P/AR, Frequency

- **Dual Display**
- **Auto Ranging**
- **Dual Channel**
- **Wide Band 40 Hz to 110 kHz**
- **Rechargeable Batteries**

RESULTS BY THE NUMBERS

1. **LOOK at the front panel menu and select the desired function.**
2. **TOUCH "ENTER" followed by the selected code number.**
3. **READ displayed results.**

It's as easy as one, two, three. Advanced technology and new design concepts allow us to produce a transmission test set that can be operated with one hand and brightly displays the results on LEDs.

The front panel serves as the operator's directory. All standard functions are logically clustered, identified, and numbered. Again, the operator only needs to follow these three simple procedures:

1. **LOOK**
2. **TOUCH**
3. **READ**

It's as simple as that—"doing it by the numbers."

The Model 1125 has been designed to be efficiently operated by technicians with varying skill levels. Because it provides integrity checks, operators quickly gain confidence and increase their productivity.

Impulse Noise Testing

The comprehensive design of the 1125 provides all prescribed noise tests of PUB 41009, with or without a holding tone.

Long term monitoring of impulse noise activity is continuously accumulated, minute by minute, over a moving 15-minute window. The most active 15-minute period and the actual time of its occurrence are stored in the memory. This feature permits convenient recall of the stored data, and readings then can be correlated with the activity of potential external noise sources. No external recording instrument is required.

Measurement Integrity

To be confident of system measurements, the user must be confident of the precision of the test set. Each time the 1125 is powered up, an integral self-test auto-routine verifies all instrument functions. If a malfunction has occurred, a displayed error code identifies the nature of the failure.

P/AR

P/AR has proven useful as a benchmark test of the ability of a circuit to carry data.

The P/AR option provides qualitative measurement of transmission impairment in response to simulated modem frequencies.

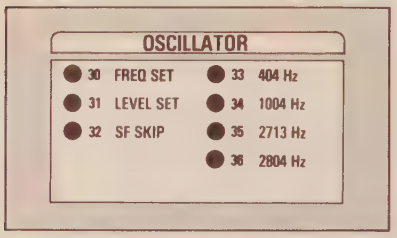
Portable Precision

Take 1125 precision anywhere it's needed.

Operation

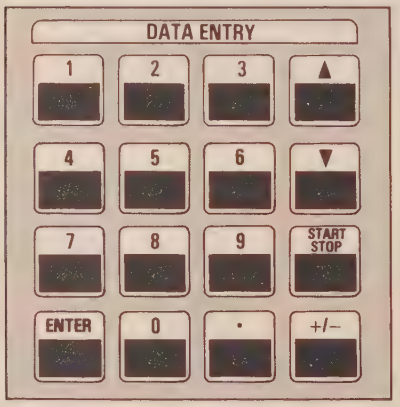
The Model 1125 is controlled by numbered commands that are listed on the front panel directory. A simple procedure, combined with a logical panel design, make the set easy to use effectively.

A. Function Listing



Lighted LED's show selected parameters; when flashing, they indicate entry request.

B. Control and Selection



All selections—FUNCTION, VALUE, and DISPLAY—are entered via the numeric pad. For example, after LEVEL SET has been selected, the following sequence sets a –16.0 dBm transmit level. (The system automatically selects a minus level unless the positive sign is entered.)

Correct commands are accepted automatically when completed. Audible feedback informs the operator of any inappropriate command entry that the test set rejects.

C. Display

Dual LED displays provide clear readings under a wide range of ambient light conditions. Either RECEIVE (14) or TRANSMIT (13) values may be displayed, as selected by the appropriate command.

Description

The Model 1125 provides an expanded complement of full-duplex transmission impairment testing functions needed to maintain both voice and data telecommunications sevices. It is as dependable and versatile under harsh field conditions as it is in the controlled environment of a C. O.

The double-walled metal enclosure design has proven exceptionally reliable and durable.

Features

- Full duplex circuit interface
- Expanded terminating impedances
- Superior hold circuits
- Sealed gel battery
- Operator prompts
- Real time clock with recall of worst 15-minute impulse noise
- Low battery indicator

APPLICATIONS

The 1125 provides those functions needed most often for transmission impairment measurement with VF, program and wideband circuits. Applications include:

Special services:

Expanded 150 ohms and 1200 ohms terminations match the actual impedance specified for certain metallic facilities. Independent Transmit and Receive selection makes it possible to accurately adjust or check circuit gain in facility termination equipment to diagnose trouble reports and to perform complete circuit acceptance testing.

Analog data line:

Standard 3-function tests are augmented by Impulse Noise and optional P/AR for detecting impairments that are particularly harmful to data transmission. For long term tests, the worst case impulse noise count is retained in memory, along with the actual time of occurrence.

Access lines:

VF transmission parameters of lines used to access toll networks. PABX trunks and other dedicated services can be measured easily and quickly.

Digital data transmission:

The extended frequency range covers all requirements for testing local loops used for digital transmission—including the DSO level. The 50k bit filter is designed specifically for this application.

Transmission Testing . . . by the numbers.

MODEL 1125 SPECIFICATIONS

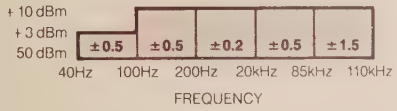
Receiver

Frequency Measurements:

Range	20 Hz to 110 kHz
Level	−50 to +10.0 dBm
Resolution	1 Hz below 10 kHz 10 Hz, 10 kHz to 99.99 kHz 100 Hz above 100 kHz
Accuracy	±0.01% or least significant digit
Update Range	5 times/second, nominal

Level Measurements:

Frequency Range	40 Hz to 110 kHz
Level Range	−50 to +10.0 dBm
Resolution	0.1 dB
Accuracy*	±0.1 dB at 1004 Hz



*Accuracy in dB applicable to all impedances

Noise Measurements:

Modes	Idle circuit noise (metallic) Noise with tone (notch) Noise-to-ground
Weighting Filters	C-message 3 kHz flat 15 kHz flat Program 50 kbit wideband
Notch Filter	1010 Hz (995–1025 Hz)
Range	10 to 100 dBrn metallic 50 to 130 dBrn, noise-to-ground
Accuracy	± 1 dB metallic with or without tone + 1.5 dB noise-to-ground with or without tone
Resolution	1 dB

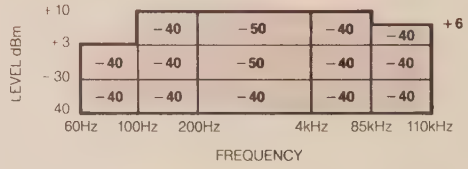
Impulse Noise Measurements:

Ref (Lo) Threshold	30 to 110 dBrn, metallic 60 to 140 dBrn, noise-to-ground
Mid Threshold	Ref + 4 dB (max. 110 dBrn metallic, max. 140 dBrn NG)
High Threshold	Ref + 8 dB (max. 110 dBrn metallic, max. 140 dBrn NG)
Reference Accuracy	± 1 dB, metallic (40 dBrn to 100 dBrn) ± 1.5 dB, noise-to-ground (70 dBrn to 140 dBrn)
Count Capacity	0 to 9999
Count Rate (nominal)	8 or 100 per second
Holding Tone Loss	−40 dBm ± 1 dB threshold
Timer Period	5, 15, 60 min. or continuous
Noise Count Display	Accumulated count and worst 15 minute history with stored time of occurrence
Clock	24 hour (hours, minutes)

Transmitter

Frequency	40 Hz to 110 kHz
Output Level	−40 to +10 dBm, ≥ 600 ohms −40 to +3 dBm (135 ohms and 150 ohms)
Resolution	1 Hz below 10 kHz 10 Hz, 10 kHz to 99.99 kHz 100 Hz above 100 kHz
Fixed Tones	404 Hz, 1004 Hz, 2804 Hz, 2713 Hz (all ±0.1%)

Total Distortion* (in dB from fundamental):



*Measured per Pub 41009, Table L

P/AR (optional):

Transmit Spectrum	A composite signal of 16 frequencies between 140 Hz and 3890 Hz
Output Level	−40 to 0 dBm (true RMS)
Receive Input	−40 to +3 dBm (true RMS)
P/AR Range	0 to 120 P/AR units
Resolution	1 P/AR unit
Accuracy	± 2 (30 to 110 units)

General:

Impedances	135, 150, 600, 900, 1200 ohms Independent selection of TRAN and REC termination
Bridging Impedance	≥ 50 k ohms
Longitudinal Balance	≥ 80 dB at 60 Hz
Hold Circuits	40 mA max. at 50 V and 0 ohms 25 mA typ. at 48 V and 1500 ohms
Primary Power	115 VAC, 30 watts, nominal
Battery	Sealed gel cell 6 volts, 10 ampere-hours
Battery Capacity	3.5 hours, nominal at 25°C
Auto Shut-Off	Battery voltage = 5.7 volts
Recharge Cycle	16 hours (with unit off)
Operating Temperature	0° to 50°C
Storage Temperature	−40° to 50°C
Dimensions	5.70″ high x 11.75″ wide x 15.30″ deep (14.5 cm x 29.8 cm x 38.9 cm) 7.0″ high with retractable cover
Weight (with battery)	19.5 lbs (8.9 kg)

Accessories:

Retractable Front Cover
Canvas Carrying Case
Rack Mount 19″ or 23″ x 5.75″ Panel Space

References:

BSTR Pub-41009 (May, 1975)
IEEE P743/DI (July, 1982)

Specifications Subject to Change Without Notice.

NOTES

VF Extender

VF w/PAR

tau-tron
A UNIT OF
GENERAL SIGNAL

Tau-tron Inc, 10 Lyberty Way, Westford, MA 01886
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SECTION 7
OPERATING INSTRUCTIONS

7.0 OPERATING INSTRUCTIONS

Operating instructions in this section include an explanation of the use and function of each control and front panel feature. Power on, test setup, and measurement operations are also provided.

7.1 FRONT PANEL FEATURES

7.1.1 ON/OFF/VOLUME SWITCH (Item 12, Fig. 7-1):

Pull to switch power on. Rotating the ON/OFF/VOL knob controls the output level of the internal monitor speaker. In the OFF (in) position, battery power is applied only to the real-time clock circuitry.

(a) Battery charging circuit is enabled whenever the unit is plugged into 110 Vac.

(1) If the unit is turned OFF, the battery will fully charge in approximately 16 hours.

(2) With the unit turned ON, only a trickle charge is fed to the battery.

(b) Unit automatically switches to battery power in the event of ac power failure.

7.1.2 TRANSFER SWITCH (Item 14):

Controls the direction of test operations. When the transfer switch is IN, the A binding posts and 310 jack are connected to the transmit side of the circuit, and the B binding posts and 310 jack are connected to the receive side of the circuit under test. With the transfer switch in the OUT position, the A connections are connected to the receive side of the circuit and the B connections are connected to the transmit side of the circuit.

7.1.3 BINDING POSTS (Item 17):

Labeled T (Tip) and R (Ring). Used to connect a butt-in handset to the telephone circuit connected to the 310 jack. Refer to paragraph 7.10 for the dial-up procedure.

7.1.4 RECEIVE SWITCH (Item 16) AND TRANSMIT SWITCH (Item 19):

Matches the 1125's terminating impedance to the characteristic impedance of the line. When set to the DIAL position, the internal measuring ciruitry (including line holding) is disconnected and a butt-in handset may be used to dial and hold through the 310 jack to the line, using the binding posts.

7.1.5 BRIDGE/TERM SWITCH (Item 15):

Used only in receive mode. When in, provides the terminating impedance selected by the RECEIVE switch (see 7.1.4). When in the out position, the receiver circuitry of the 1125 presents a high impedance at its input (greater than 50K ohms).

7.1.6 ENTRY KEYPAD (Item 13):

Used to enter the operator's instructions. All functions and selections are numerically coded on the front panel of the 1125, and the code corresponding to the desired selection is entered at the keypad.

(a) The (UP) and (DOWN) keys may be used to increment or decrement the values entered in FREQUENCY, LEVEL, or REFERENCE SET modes.

(1) Values change by +100 Hz in the FREQUENCY SET mode. Hold the key in for continuous incrementing/decrementing.

(2) Values change by +0.1 dBm in LEVEL SET mode.

(3) Values change by +1 dBm in REFERENCE SET mode.

(b) The +/- key is used when entering positive values. A default negative value is assigned to all level inputs unless this key is depressed.

7.1.7 DISPLAY Section (Item 3):

LEDs indicate whether the measurements of the TRANSMIT [13] or the RECEIVE [14] side of the circuit under test are being displayed.

7.1.8 LEFT DISPLAY (Item 6):

Will display a value as determined by the mode selected; an LED to the right of the display will indicate the unit of measurement.

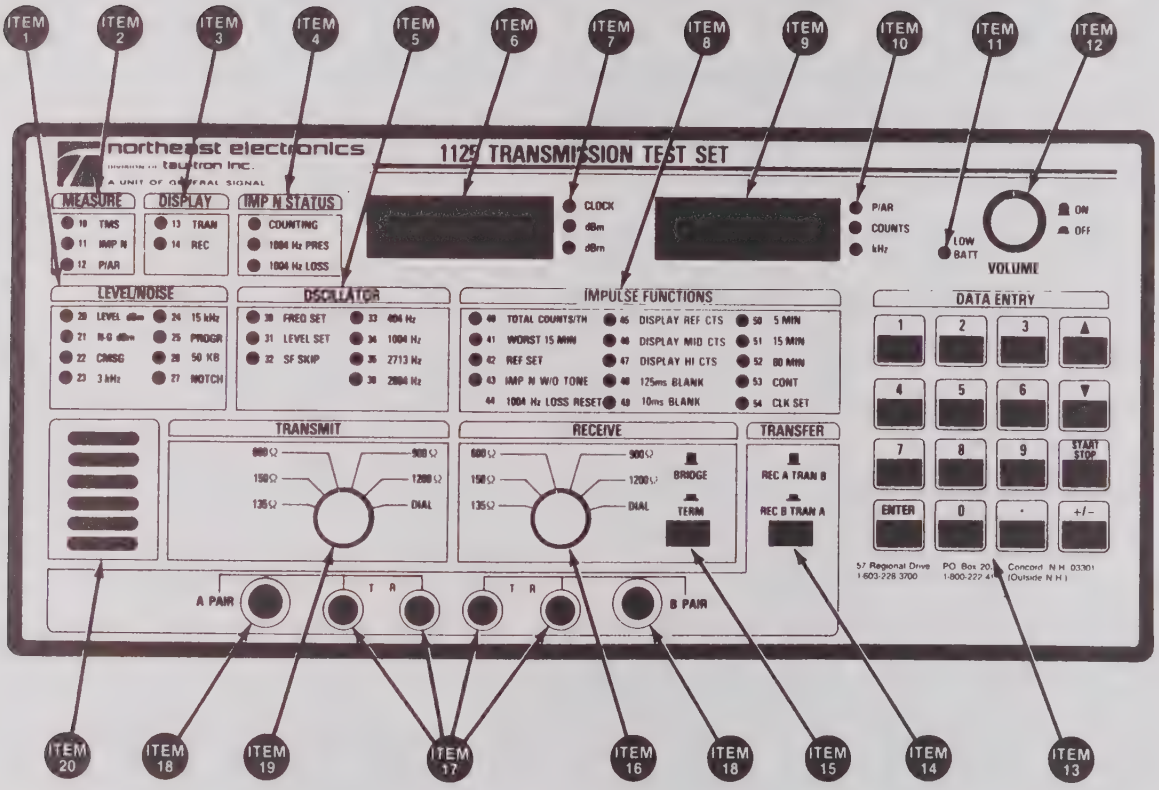

Figure 7.1 1125 Transmission Test Set Front Panel

(a) TMS Mode:

(1) Transmit signal level in dBm

(2) Receive noise measurement in dBrn

(3) Receive level measurement in dBm.

(b) IMPULSE NOISE Mode:

(1) 24-hour real time while test is in progress, or when CLKSET 54 is selected

(2) Start time of worst 15-minute counting period

(3) Impulse noise reference level in dBrn

(c) P/AR Mode (Peak-to-Average Ratio):

Receive or transmit P/AR signal level in dBm.

LEGEND
FRONT PANEL REFERENCE GUIDE

ITEM #	SECTION	SECTION #		REFERENCE
1	Level/Noise	20	LEVEL dBm	7.1.11
		21	N-G dBrn	
		22	CMSG	
		23	3 kHz	
		24	15 kHz	
		25	PROGR	
		26	50 KB	
		27	NOTCH	
2	Measure	10	TMS	7.1.10
		11	IMP N	
		12	P/AR	
3	Display	13	TRAN	7.1.7
		14	REC	
4	IMP N Status		COUNTING	7.1.14
			1004 Hz PRES	
			1004 Hz LOSS	
5	Oscillator	30	FREQ SET	7.1.12
		31	LEVEL SET	
		32	SF SKIP	
		33	404 Hz	
		34	1004 Hz	
		35	2713 Hz	
		36	2804 Hz	
6	Left Display			7.1.8
7	Left Display (Function)		CLOCK	7.1.8
			dBm	
			dBrn	

LEGEND - (Cont'd)
FRONT PANEL REFERENCE GUIDE

ITEM #	SECTION	SECTION #	REFERENCE
8	Impulse Functions	40 TOTAL COUNTS/TH 41 WORST 15 MIN 42 REF SET 43 IMP N W/O TONE 44 1004 Hz LOSS RESET 45 DISPLAY REF CTS 46 DISPLAY MID CTS 47 DISPLAY HI CTS 48 125 ms BLANK 49 10 ms BLANK 50 5 MIN 51 15 MIN 52 60 MIN 53 CONT 54 CLOCK SET	7.1.13 7.1.13
9	Right Display		7.1.9
10	Right Display (Function)	P/AR COUNTS kHz	7.1.9
11	Low Batt		3.02
12	On/Off Volume		2.01
13	Data Entry Keypad		2.06
14	Transfer	OUT REC A TRAN B IN REC B TRAN A	7.1.2
15	Receive Bridge/Term	OUT BRIDGED IN TERMINATED	7.1.5
16	Receive	135 150 600 900 1200 DIAL	7.1.4
17	Binding Posts		7.1.3
18	310 Jacks		7.2.5
19	Transmit	135 150 600 900 1200 DIAL	7.1.4
20	Speaker		

7.1.9 RIGHT DISPLAY (Item 9):

Will display a value as determined by the mode selected; the LED to the right of the display will indicate the unit of measurement.

(a) TMS Mode: Receive or transmit signal frequency in kilohertz.

(b) IMPULSE NOISE Mode: Displays counts (hits) above threshold. Either total counts per threshold, worst 15-minute counts, or REF, MID or HI counts (depending on selection) may be displayed.

(c) P/AR Mode: Receive or transmit P/AR measurement reading in P/AR units.

7.1.10 MEASUREMENT Section (Item 2):

Operator selects the measurement to be made by pressing the ENTER key on the keypad, followed by the numeric code of the desired measurement type.

10 TMS (Transmission Measurement Set)

11 IMP N (Impulse Noise)

12 P/AR (Peak-to-Average Ratio) (optional)

7.1.11 LEVEL/NOISE Section (Item 1):

Operator may select the desired filter or function by pressing the ENTER key, followed by the numeric code of the desired filter or function.

20 Level dBm (Note 1)

21 N-G dBrn (Noise-to-ground) (Note 1)

22 CMSG (C-Message filter) (Note 2)

23 3 kHz (3 kHz flat filter) (Note 2)

24 15 kHz (15 kHz flat filter) (Note 2)

25 PROGR (Program filter) (Note 2)

26 50 KB (50 kBit wideband filter) used for testing digital transmission local loops, including DSO level.

27 NOTCH (1010 Hz notch filter)

Note 1: If both the LEVEL LED and the N-G LED are OFF, then the 1125 is in the NOISE mode (for measuring metallic noise).

Note 2: Characterization of noise filter requires a continuous signal at a preferred reference level of -10.0 dBm.

7.1.12 OSCILLATOR Section (Item 5):

Test operator selects the level and frequency of oscillator functions by entering the actual frequency and level desired, or by entering the numeric codes of the fixed frequencies provided.

30 FREQ SET (frequency set)

31 LEVEL SET

32 SF SKIP: When used, does not allow any frequency between 2450 Hz and 2750 Hz to be programmed in, to prevent accidental disconnection of lines. When 100 Hz stepping isbeing used, it will "jump over" those frequencies.

33 404 Hz

34 1004 Hz

35 2713 Hz

36 2804 Hz

7.1.13 IMPULSE FUNCTIONS Section (Item 8):

With the 1125 in the IMP N mode and set to RECEIVE, the operator may set the threshold for measuring hits and select the total time for making measurements by pressing the ENTER key, followed by the desired function. An audible signal will sound on each occurrence of a noise spike. Tone volume can be adjusted with the volume control (fig. 7-1, Item 12).

40 TOTAL COUNTS/TH: The 1125 will count all hits at or above the preset threshold value.

41 WORST 15 MIN: The 1125 will recall from its memory a record of the worst 15-minute measurement period, along with the real time of occurrence. The 1125 allows a maximum of 255 counts per threshold during any one minute; if exceeded, display will read "OR15".

42 REF SET: Enables the operator to set the reference value (threshold) for impulse noise measurements.

43 IMP N W/O TONE: Impulse noise without tone.

44 1004 Hz LOSS RESET: Resets and arms the 1004 Hz loss indicator LED (paragraph 7.1.14).

45 DISPLAY REF CTS: The total number of hits above the reference threshold is displayed.

46 DISPLAY MID CTS: The total number of hits 4 dB above the MID threshold is displayed.

47 DISPLAY HI CTS: The total number of hits 8 dB above the HI threshold is displayed.

Note: The worst 15-minute [41] period may be called out for each threshold if 60 minutes [52] or Continuous [53] is selected and at least 15 minutes of counting has occurred.

48 125 ms BLANK: Disables counting for 125 ms after a hit.

49 10 ms BLANK: Disables counting for 10 ms after a hit.

50 5 MIN: Length of measurement period is 5 minutes.

51 15 MIN: Length of measurement period is 15 minutes.

52 60 MIN: Length of measurement period is 60 minutes.

53 CONT: Continuous measurement.

54 CLOCK SET: Used to set and/or display the real time.

7.1.14 IMP N STATUS (Item 4):

Impulse noise measurement status is indicated by three LEDs.

(1) Counting LED: Lit during the counting intervals of 5 minutes, 15 minutes, 60 minutes, and continuous. The LED will light when the start button is pressed, and go out after the selected time interval has elapsed.

(2) 1004 Hz PRES: Lit when a 1004 Hz tone is present, and go out when the tone goes below -40 dBm for more than 125 ms. The LED will relight when tone reappears for more than 125 ms.

(3) 1004 Hz LOSS: Lit if a 1004 Hz tone is not present, or if the 1004 Hz has dropped below -40 dBm for more than 125 ms. To turn off the 1004 Hz LED:

ENTER 4 4

7.1.15 SPEAKER:

Allows audible monitoring of the received or transmitted signal, entries keyed into the data entry keypad, and impulse noise spikes.

7.2 SETUP

7.2.1 The following paragraphs describe setup procedures for the use of the 1125 Transmission Test Set. Specific procedures for a variety of tests may be found in paragraphs 7.3 through 7.10.

7.2.2 DC power option:

Units equipped with the dc power option operate on 110 ac, with a battery back-up system. If the unit is connected to an ac outlet, the battery is charging. The 1125 may be used on battery power for up to 3 1/2 hours. A low battery indicator on the front panel (Item 11, Fig. 7-1) indicates operational time is limited to 15 to 30 minutes; the unit should be connected to ac power to fully charge the battery.

(a) If the unit must be left on while charging, it will receive a trickle charge.

(b) With the unit turned off, battery will be fully charged in approximately 16 hours.

7.2.3 Power on:

Pull the ON/OFF/VOL switch out to turn the unit on.

(a) All the front panel LEDs and all segments of both displays should light. No error codes should be displayed.

(1) The transmit signal is automatically looped through the filters to the receiver station.

(2) The output of each filter is checked to verify that the signal is within specified parameters. "Out-of-spec" signals cause error codes. Refer to paragraph 7.11.

(b) The 1125 will default to TMS [10], TRAN [13], and LEVEL [20], at 0.0 dBm and 1.004 kHz.

(c) The operator may exit from any function mode by entering another function.

7.2.4 Setting the clock:

Set the real time clock by entering the following sequence:

ENTER 5 4

The time should appear on the left display, and the CLOCK SET LED should blink. Time is displayed in 24-hour format (3 PM is displayed as 15.00). If the time display is incorrect, enter the correct time at the keypad, then press ENTER 5 4, again to exit from the CLOCK SET mode. The CLOCK SET LED will stop blinking. Note that the clock circuitry is powered by battery even when the 1125 is turned off and unplugged.

7.2.5 Test setup:

Set up the unit for testing a circuit:

(a) Connect a 310 cord from the circuit under test to the front panel jacks on the 1125. Press the transfer switch to the appropriate position:

(1) If the receive side of the circuit under test is to be connected to the B 310 jack, the TRANSFER switch should be in.

(2) If the receive side of the circuit under test is to be connected to the A 310 jack, the TRANSFER switch should be out.

(b) Set the TRANSMIT switch (Item 19, Fig. 7-1) to the position which matches the impedance of the transmit side of the circuit under test.

(c) Set the RECEIVE switch (Item 16, Fig 7-1) to the position which matches the impedance of the receive side of the circuit under test.

(d) If the RECEIVE circuit is to be measured in the BRIDGED mode, push the BRIDGE/TERM switch (Item 15, Fig. 7-1) so that it is in the out position.

7.2.6 Instructions for performing tests begin with paragraph 7.3.

7.3 TRANSMITTER LEVEL AND FREQUENCY

7.3.1 Initial setup:

Table 7-1 shows the keypad entries used to set up the 1125 to display the level and frequency of the signal being generated by the test set.

7.3.2 Changing level and frequency:

Table 7-2 shows the steps used to set or change the level and frequency of a signal being transmitted by the 1125.

TABLE 7-1
TRANSMITTER LEVEL AND FREQUENCY

OPERATOR ACTION (KEYSTROKES)	FUNCTION	INDICATORS
ENTER 1 0	TMS mode	[10] TMS LED lit
ENTER 2 0	Level mode-all filters bypassed	[20] LEVEL LED lit
ENTER 1 3	Display transmit signals	Left display shows level, right display shows frequency of the transmitted signal.

TABLE 7-2
CHANGING LEVEL/FREQUENCY

OPERATOR ACTION (KEYSTROKES)	FUNCTION	INDICATORS
ENTER 3 1 1 0 . 4	Set level mode Sets output level to -10.4 dBm (Note 1) and (Note 3)	[31]LEVEL SET LED blinking -10.4 on left display: dBm LED LIT
ENTER 3 0	Set frequency mode	[30] FREQ SET LED blinking
METHOD A - Use for ANY frequency		
ENTER . 4 4 0	Set desired frequency	0.440 on right display; kHz LED lit.
ENTER 9 . 9 9 0	Change to new frequency (Note 2)	9.990 on right display; kHz LED lit.
METHOD B - Use with built-in standard frequencies		
ENTER 3 3	Sets the transmitter to a frequency of 404 Hz	[33] 404 Hz LED lit; 0.404 kHz on right display
ENTER 3 4	Sets the transmitter to a frequency of 1004 Hz	[34] 1.004 Hz LED lit; 1.004 kHz on right display
METHOD C - Used when SF (Single Frequency) signalling units are used in the circuit under test.		
ENTER 3 2	Disables the selection of any frequency in the range of 2450 to 2750 Hz to prevent accidental circuit disconnect.	[32] SF SKIP LED lit
Example: ENTER 3 5	Attempt to use 2713	Audible double-beep

Notes: Refer to 7.1.6 to increment or decrement the value entered. The most frequently changed parameter should be entered last to reduce the number of keystrokes. Values are negative unless the +/-key is pressed. Press the +/- key only when positive values are entered.

7.4 LEVEL AND FREQUENCY MEASUREMENTS

7.4.1 Monitoring level and frequency:

The sequence given in Table 7-3 allows an operator to monitor the level and frequency of a signal on a circuit being tested by the 1125.

7.4.2 The level of the signal will be displayed on the left display; the frequency of the signal will appear on the right display.

7.4.3 Signal level range:

If the signal level is greater than +10.3 dBm, an over range (Or) symbol will appear in the left display. If the signal is less that -50.0 dBm, an under range (Ur) symbol will appear.

7.4.4 Frequency range:

If the frequency is less than approximately 20 Hz, LO appears in the right display. If the frequency is higher than about 110 kHz, HI appears in the right display.

TABLE 7-3
LEVEL AND FREQUENCY MEASUREMENTS

STEP	ACTION	FUNCTION	INDICATORS
1	Set transfer switch as required		
2	ENTER 1 0	TMS mode [10].	TMS LED lit.
3	ENTER 1 4	Receive [14] side.	REC LED lit.
4	ENTER 2 0	Level [20].	LEVEL LED lit.

7.4.5 Entering Quiet Termination Mode: The quiet termination mode can be entered from either a transmit level or noise level function by following the steps in Table 7-4.

7.4.6 Exiting Quiet Termination Mode: The quiet termination mode is released from either a transmit level or transmit noise mode by following the steps in Table 7-5.

TABLE 7-4
ENTERING QUIET TERMINATION MODE

STEP	ACTION	FUNCTION	INDICATORS
1	ENTER . .	Transmitter is still on until receive mode is entered, or the frequency is changed.	Transmit level will display OFF. Frequency is blanked.
2	ENTER 1 4	Receive mode. Transmitter is turned off and stays off until a level set operation is performed.	REC LED lit.

TABLE 7-5
EXITING QUIET TERMINATION MODE

STEP	ACTION	FUNCTION	INDICATORS
1	ENTER 3 1	Set level mode.	LEVEL SET LED BLINKS.
2	ENTER +/- 10.0	Set output level to +10.0 dBm.	+10.0 on left display, dbm LED lit.
NOTE: Quiet termination is dropped after any valid level is entered during level set operation.			

7.5 METALLIC NOISE MEASUREMENTS

7.5.1 Procedure:

Metallic noise level in dBrn may be measured by entering the sequence given in Table 7-6 (Note 1).

7.5.2 Metallic noise level (10 to 100 dBrn) will appear in the left display. Ur indicates the noise level is less than 10 dBrn.

Note 1: If both the LEVEL LED and the N-G LED are off, the 1125 is in the (metallic) noise mode. The noise filter in use is indicated by the illuminated LED; 7.1.11 lists noise filters available.

TABLE 7-6
METALLIC NOISE MEASUREMENTS

STEP	ACTION	FUNCTION	INDICATORS
1	Set TRANSFER SWITCH as required		
2	ENTER 1 0	TMS mode [10]	[10] TMS LED lit
3	ENTER 1 4	Receive [14] side	[14] REC LED lit
4	ENTER X X	Select desired filter ([22] through [27])	Filter LED lit

7.6 NOISE-TO-GROUND MEASUREMENTS

7.6.1 Grounding:

For accurate impulse noise-to-ground measurements, the 1125 must be properly grounded.

(a) Connect an external lead from frame (circuit) ground to the binding post on the rear of the instrument during battery operation, or

(b) Use a properly grounded 3-wire 110 V ac outlet.

7.6.2 Procedure:

Refer to Table 7-7 for setup procedure. The impulse noise-to ground level (between 50 and 130 dBrn) appears in the left display.

TABLE 7-7
NOISE-TO-GROUND MEASUREMENTS

STEP	ACTION	FUNCTION	INDICATORS
1	ENTER 1 0	TMS mode	TMS LED lit
2	ENTER 1 4	Measure RECEIVE [14] side	REC LED lit
3	ENTER 2 1	NOISE TO GROUND	N-G LED [21] lit
4	ENTER 2 X	Select the desired filter	Filter LED lit

7.7 NOISE-WITH-TONE-MEASUREMENTS

7.7.1 Noise filter:

The 1125 is equipped with a 1010 Hz filter for making noise with tone (notch noise) measurements.

7.7.2 Procedure:

Table 7-8 shows the keypad sequence for initiating noise-with-tone measurements. Read the noise level (10 to 100 dBrn) on the left display.

TABLE 7-8
NOISE-WITH-TONE MEASUREMENTS

STEP	ACTION	FUNCTION	INDICATORS
1	ENTER 1 0	TMS mode	TMS LED lit
2	ENTER 1 4	Receive side	REC LED [14] lit
3	ENTER 2 X	(Select filter)	Filter LED lit
4	ENTER 2 7	Notch filter	NOTCH FILTER LED [27] lit

7.8 IMPULSE NOISE MEASUREMENTS

7.8.1 The following parameters should be understood by the 1125 operator before attempting to measure impulse noise:

(a) Reference Level: This is an operator-selected threshold level; any impulse noises above this level register as hits or counts. The MID level and the HI level are automatically set at 4 dB and 8 dB above this reference level.

(b) Time Duration: Impulse noise, by its nature, is a random phenomenon; therefore, the longer the measurement period, the greater the reliability of the data. The 1125 offers a choice of four time intervals: 5, 15, or 60 minutes, or continuous. In any mode, counting may be stopped by pressing the START/STOP key.

(c) Blanking Time: Large noise spikes may cause oscillation or ringing. To prevent multiple counts of the same spike, it is necessary to disable the counter for a period of time after a hit. The 1125 operator may select either 10 milliseconds [49] or 125 milliseconds [48] of blanking. If no selection is made, the 1125 will default to a 125 ms blanking period.

Example:

Refer to Fig. 7.8-1. The noise spike at (A) crosses the HIGH threshold, and triggers the blanking circuitry. This spike will count as a reference hit, a MID hit, and a HIGH hit, since it crosses all three thresholds. The spikes at (B) and (C) are oscillations (ringing) and are not counted as hits, because they occur during the time the counter is blanked. The spike at (D) crosses the reference threshold, and will count as a hit and trigger the blanking circuitry. It will not be included in the count of MID or HIGH hits. The spike at (E) would count as a MID and a HIGH hit, but not a reference hit, since the spike at (D) has blanked the reference threshold count. The spike at (F) triggers the blanking circuitry and is included in the count of reference hits and MID hits.

(d) 1004 Hz Loss: Impulse noise measurements are normally done with a 1004 Hz tone. If the tone is lost, or if it falls below -40 dBm for more than 125 milliseconds, the 1125 stops counting impulse noise and the 1004 Hz LOSS LED lights. To turn off the 1004 Hz LOSS LED enter:

ENTER 4 4

The 1125 will start counting again when the 1004 Hz tone returns. Starting another IMP N measurement will also reset the LED.

(e) Total Counts/TH: Entering

ENTER 4 0

will display the total number of counts above the selected threshold. This can be done during or after the counting period.

(f) Worst 15 Min: Impulse noise is a random phenomenon which generally occurs in bursts. The time of occurrence of these bursts may provide useful information regarding the nature of the fault. The 1125 allows the operator to see the starting time of the worst 15 minutes of a 60-minute or longer test. If more than 225 counts per minute are measured, the display indicates OR 15. The recall of the worst 15 minutes is valid only if the test has run for at least 15 minutes in the 60-minute or continuous mode.

7.8.2 Impulse Noise:

Use Table 7-9 to initiate impulse noise measurements on the circuit under test. Note that the 1125 defaults to commonly used settings which may be manually altered.

7.8.3 Impulse specifications are listed in Section 6. Specifications are from publications IEEE P743/01.

TABLE 7-9
IMPULSE NOISE MEASUREMENTS

STEP	ACTION	FUNCTION	INDICATORS	COMMENT
1	ENTER 1 1	Measure impulse noise	IMP N LED[11] lit	By default, the C-MSG and notch filters are selected, and the blanking time set to 125 ms with 60 dBrn reference threshold and 15-minute interval.
2	ENTER 1 4	Receive side	REC LED lit	Unit displays time and counts
Options:				
3	ENTER 2 X	Select filter		
4	ENTER 3 4	Set oscillator to 1004 Hz	1004 Hz LED [34] lit	
5	ENTER 4 2	Set reference level	REF SET [42] LED should blink	
6	ENTER X X	Enter the reference level	Digits entered show in left display; dBrn LED next to left display lit	
7	ENTER 4 8/9	Set blanking time	BLANK LED lit [48] or [49]	
8	ENTER 5 X	Select measurement time	LED [50][51][52] or [53] lit	
9	START/STOP	Start counting	The COUNTING LED should be on and the 1004 Hz PRES and LOSS LEDs will be lit	

Table 7-9 (cont)
Impulse Noise Measurements

STEP	ACTION	FUNCTION	INDICATORS	COMMENT
10	START/STOP	Stop counting	The COUNTING LED will go out	
11	ENTER 4 3	Measure impulse noise without tone	IMPN without tone LED lit	1004 Hz tone and notch filter not required
12	ENTER 4 1	Worst 15-minute recall recall	Worst 15-minute LED lit	Start time of worst 15 minute shown on left display Counts during worst interval shown on right display.
13	ENTER 4 5		Display REF CTS lit	Counts for each threshold displayed in right display
	4 6		Display MID CTS lit	
	4 7		Display HI CTS lit	

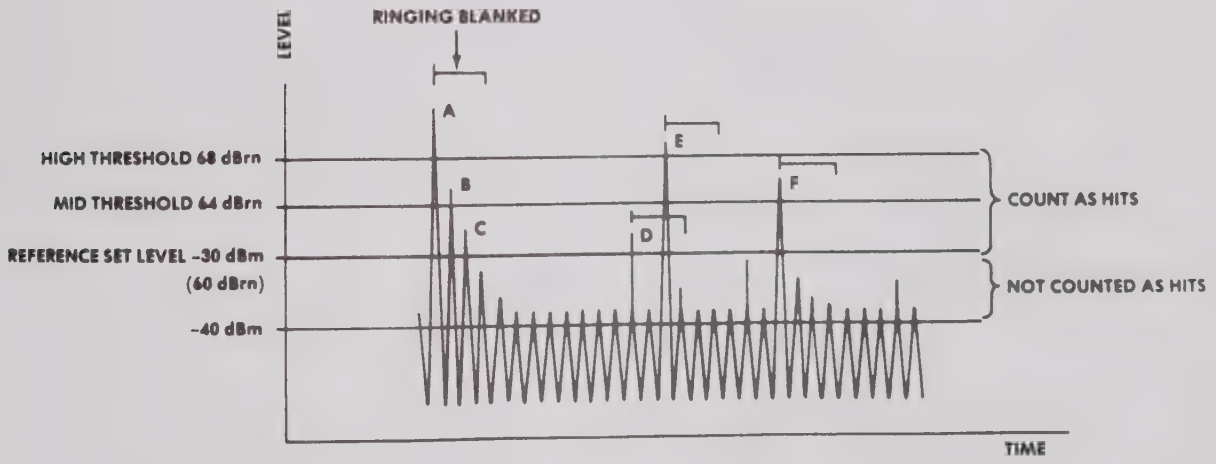

Figure 7.8-1 Impulse Noise Reference Levels

7.9 P/AR MEASUREMENTS

7.9.1 Purpose:

The optional P/AR system is designed to measure the simultaneous effects of bandwidth reduction, envelope delay distortion, and return loss due to gain and phase ripples on voiceband data signals.

7.9.2 Measurements:

P/AR measurements are not affected by transient phenomena, frequency shifts, or noise.

7.9.3 P/AR system:

The P/AR system consists of a transmitter and a receiver connected to opposite ends of a voice band transmission system.

(a) The transmitter generates a complex line signal with no even harmonics, producing a pulse train with a half-wave symmetry. The peak-to-average ratio of the signal is known.

(b) The receiver measures the peak and average values of the received signal, and displays their ratio, which is the basis for the P/AR rating.

(c) A P/AR rating of 100 signifies that the pulse train measured has suffered no degradation, compared to the pulse train transmitted.

(d) P/AR specifications are listed in Section 6. Additional information on P/AR systems is in BELL SYSTEM PUBLICATIONS 41009.

7.9.4 Transmit procedure:

To transmit a P/AR signal, use the sequence given in Table 7-10.

TABLE 7-10
TRANSMITTING P/AR SIGNALS

STEP	ACTION	FUNCTION	INDICATORS
1	ENTER 1 2	P/AR mode	P/AR LED lit
2	ENTER 1 3	Display transmitted signal	TRAN LED [13] lit
3	ENTER 3 1	Set level	LEVEL SET LED [31] lit
4	ENTER 0 0	Level set to 0.0 dBm	0.0 in left display
5	Read level in dBm on left display and P/AR units on right display.		

7.9.5 Measurement procedure:

To measure a P/AR signal, use the sequence given in Table 7-11.

TABLE 7-11
MEASURING P/AR SIGNALS

STEP	ACTION	FUNCTION	INDICATORS
1	ENTER 1 2	P/AR mode	P/AR LED [12] lit
2	ENTER 1 4	Display received signal	REC LED [14] lit
3	Read the P/AR measurement on the right display.		

7.10 DIAL PROCEDURE

7.10.1 The 1125 has the ability to hold wet dial-up lines. Use the following sequence:

(a) Connect patch cord from circuit under test to the A or B 310 jack. Refer to Fig. 7.10-1 for butt-in and circuit connection to the 1125.

(b) Connect a butt-in handset to the binding posts of the selected 310 jack.

(c) Set either the TRANSMIT or the RECEIVE switch, as appropriate, to the DIAL position. Seize the circuit by switching the handset from "monitor" to "talk".

(d) Use the butt-in handset to dial the far end of the circuit.

(e) After the circuit is answered, switch to the desired impedance to continue testing.

(f) Disconnect the butt-in handset (preferable) or return its mode switch to the "monitor" position (Note 1).

(g) To disengage, put the switch back in the DIAL position.

Note 1: The bridging loss caused by leaving the handset connected may degrade the measurement of a tone on the circuit.

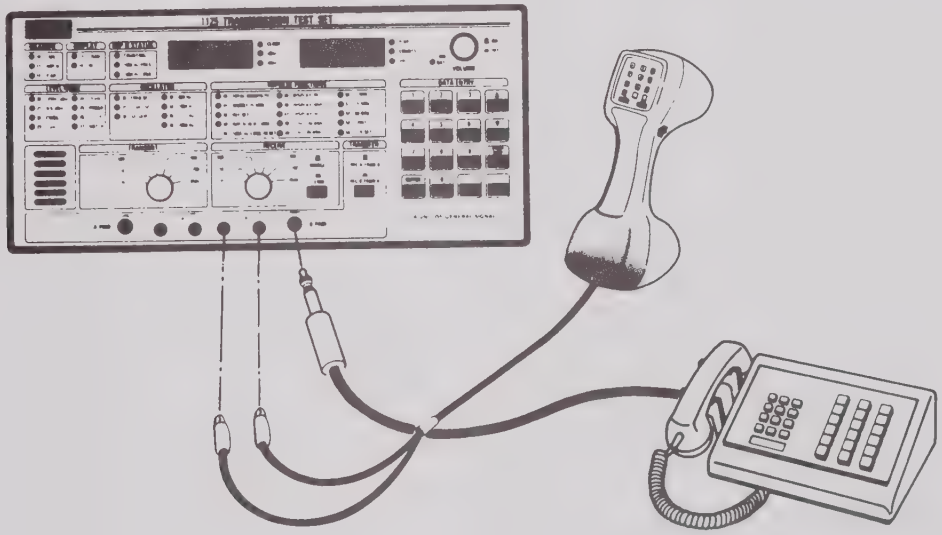

Figure 7.10-1 Dial-up Connections

7.11 FAILURE MESSAGES

7.11.1 When switched on, the 1125 enters a self-test mode to check its internal circuitry. Results of each test appear in the left display as either PASS or FAIL. The test number appears in the right display.

7.11.2 Table 7-12 is a list of the test numbers and the circuit that is tested.

TABLE 7-12
FAILURE MESSAGES

TEST NUMBER	CIRCUIT TESTED
1	Accuracy of built-in 10V reference
11	IMP N measurement
12	P/AR measurement
20	TMS measurement
22	C-MSG filter
23	3 kHz filter
24	15 kHz filter
25	PROG filter
26	50 kB filter
27	1004 Hz Notch filter

Feedback

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To return a unit for repair:

1. Call the Customer Service Dept. (508) 692-5100 or 1-800-344-8131(outside MA), for a **Repair Authorization Number.** This will reduce administrative delays and ensure prompt return of your unit.
2. Complete and **attach one of the Repair Tags** below to your unit.
3. **Pack the unit** in the original shipping carton and packaging materials, if available. Otherwise use a double-walled carton (test strength of 350 lb) and shock absorbing material such as bubble wrap to prevent the unit from moving in the carton during transit. Seal with heavy paper tape.
4. **Send to:**

   Tau-tron
   10 Lyberty Way
   Westford, MA 01886
   attn: Customer Service

Repair Tag

Repair Authorization Number _____

Model _____ **Serial Number** _____

☐ Warranty repair ☐ Dead on arrival ☐ Repair ☐ Modification ☐ Recalibration

Symptoms: _____

_____

Name _____ Title _____

Company _____ Dept./MS _____

Address _____ City _____

State&Zip _____ Phone _____

Form 0163-1181A

Repair Tag

Repair Authorization Number _____

Model _____ **Serial Number** _____

☐ Warranty repair ☐ Dead on arrival ☐ Repair ☐ Modification ☐ Recalibration

Symptoms: _____

_____

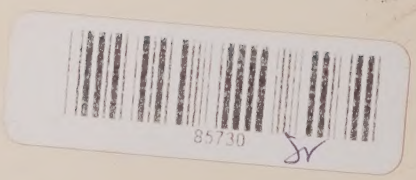
Name _____ Title _____

Company _____ Dept./MS _____

Address _____ City _____

State&Zip _____ Phone _____

Form 0163-1181A



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